6400 Line Matrix Printers

Maintenance Information Manual

Cabinet and Pedestal Models

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S246–0117–06

Maintenance Information Manual

Cabinet and Pedestal Models

Note!

Before using the information and the product it works with, make sure you read the general information under “Notices,” located right after the Table of Contents.

Seventh Edition (October 1998)

This edition applies to the 6400 Line Matrix Printer.

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ENERGY STAR

The EPA ENERGY STAR** Computers program is a partnership effort with manufacturers of data processing equipment to promote the introduction of energy-efficient personal computers, monitors, and printers, and to reduce air pollution caused by power generation.

IBM participates in this program by introducing printers that reduce power consumption when they are not being used. This feature can cut energy use by up to 50 percent.

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Electrical Safety

This printer is inspected and listed by recognized national testing laboratories, such as Underwriters Laboratories, Inc. (UL) in the U.S.A. and Canadian Standards Association (CSA) in Canada. Listing of a product by a national testing laboratory indicates that the product is designed and manufactured in accordance with national requirements intended to minimize safety hazards. IBM equipment meets a very high standard of safety in design and manufacture. Remember,

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IGP	Printronix, Inc.
MS-DOS	Microsoft Corporation
PrintNet	Printronix, Inc.
Printronix	Printronix, Inc.
SureStack	Printronix, Inc.
Torx	Camcar/Textron Inc.

Safety Notices

Danger and Caution notices are numbered to help you find the translated versions in the *IBM 6400 Line Matrix Printer Safety Notices* booklet.

DANGER:

<2> Switch off printer power and unplug the printer power cord before cleaning the printer.

<3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.

<4> Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.

<5> Power off the printer and disconnect the power cord before connecting or disconnecting communication port, teleport, or attachment cable connector.

CAUTION:

<2> Over time the upper edge of the paper ironer can become sharp. To avoid cutting yourself handle the paper ironer on the sides.

<4> To prevent injury from electric shock, wait at least one minute after powering off before removing the power supply circuit board.

<5> The constant force spring is a high tension spring. To avoid pinching your fingers, coil the spring slowly and carefully. Do not let the spring twist or crimp.

1 Maintenance Overview

About the Printer

The entire system architecture of an IBM* 6400 line matrix printer is contained on one circuit board. The use of DRAM and flash memory on this board permits rapid access to stored printer emulations and fast processing of print data. A variable-speed shuttle and half-step paper control enables the printer to print a wide variety of high-volume jobs with minimum maintenance and maximum reliability.

Although technologically advanced, the printer is easy to use. The operator can select every printer function at the control panel or by sending printer control codes in the data stream from the host computer.

This is also an excellent graphics printer, with optional features that simplify the creation of dot images. The IGP** and Code V** Printronix** emulations are simple but versatile graphics programming languages that load into flash memory.

The IBM 6400 Series Printer Family

The IBM 6400 Line Matrix Printer family consists of pedestal mount and floor cabinet models that print at different speeds, as shown in Table 1. The print speeds listed in Table 1 are the maximum speeds attainable under certain conditions. Actual print speed is determined by the interaction of many variables. For more information, refer to the discussion of Printing Rates in Appendix B, page 342.

Models that print 475, 500, 800, 900, and 1000 lpm are available in floor cabinet and pedestal housings. Models that print 1200, 1400, and 1500 lpm are available only in floor cabinets.

Table 1. The IBM 6400 Series Printer Family

Model Number	Print Speed	Enclosure	Hammer Bank	Data Controller Clock[1]
6400–004	475 lpm	Cabinet	28 Hammers	25 MHz
6400–04P	475 lpm	Pedestal	28 Hammers	25 MHz
6400–005	500 lpm	Cabinet	28 Hammers	25 MHz
6400–05P	500 lpm	Pedestal	28 Hammers	25 MHz
6400–050	500 lpm	Cabinet	28 Hammers	40 MHz
6400–P50	500 lpm	Pedestal	28 Hammers	40 MHz
6400–008	800 lpm	Cabinet	49 Hammers	25 MHz
6400–08P	800 lpm	Pedestal	49 Hammers	25 MHz
6400–009	900 lpm	Cabinet	49 Hammers	25 MHz
6400–09P	900 lpm	Pedestal	49 Hammers	25 MHz
6400–010	1000 lpm	Cabinet	60 Hammers	40 MHz
6400–P10	1000 lpm	Pedestal	60 Hammers	40 MHz
6400–012	1200 lpm	Cabinet	91 Hammers	25 MHz
6400–014	1400 lpm	Cabinet	91 Hammers	40 MHz
6400–015	1500 lpm	Cabinet	102 Hammers	40 MHz

[1] The microprocessor of the Data Controller unit on the CMX controller board runs at 25 MHz or 40 MHz, depending on printer model. This means there are two kinds of CMX controller board for IBM 6400 printers, used as shown in Table 1. The 40 MHz controller board, however, is backwards compatible in all models that use the 25 MHz board.

Printer Evolution

IBM 6400–050, –P50, –010, –P10, and –015 printers use a redesigned shuttle frame assembly, hammer bank, and ribbon guides which are not compatible with earlier models. These models use the CMX 040 controller board, which has a 40 MHz clock speed on the Data Controller unit.

How to Identify the Printer

The model number of the printer indicates printer family, speed, and type of enclosure. (See Figure 1.)

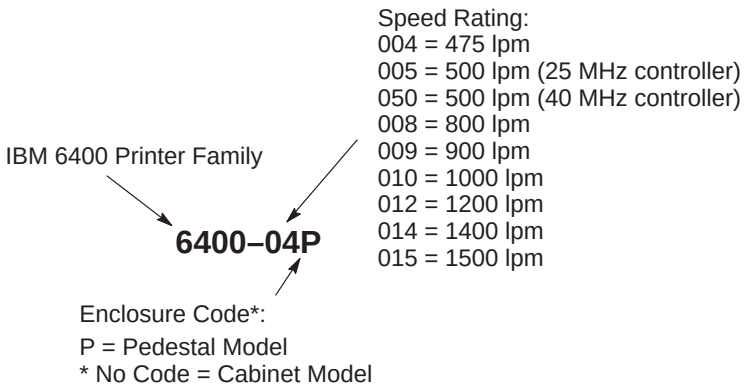

Speed Rating:
004 = 475 lpm
005 = 500 lpm (25 MHz controller)
050 = 500 lpm (40 MHz controller)
008 = 800 lpm
009 = 900 lpm
010 = 1000 lpm
012 = 1200 lpm
014 = 1400 lpm
015 = 1500 lpm
IBM 6400 Printer Family
6400–04P
Enclosure Code*:
P = Pedestal Model
* No Code = Cabinet Model

Figure 1. Interpreting the Printer Model Number

Important Maintenance Notes

ATTENTION

Failure to observe the following guidelines can result in damage to the equipment.

To ensure the best performance of the printer, remember these important maintenance concepts when you service the printer:

- Do not adjust the platen gap unless the original shuttle frame assembly or platen has been replaced with a new or rebuilt unit, or unless instructed to do so in the troubleshooting chapter.
- Never bend or “tweak” hammer springs. Always handle hammer springs by the thick mounting base. The hammer springs and hammer tips are delicate and precisely aligned.
- Use only the ribbons specified in Appendix B. Use of incorrect ribbons can lead to ink migration problems, degraded print quality, and expensive damage to the printer.
- Do not close the forms thickness lever too tightly. Closing the forms thickness lever too tightly can lead to smearing, degraded print quality, paper jams, and damage to the platen and shuttle assembly.

About This Manual

This is a field service maintenance manual. It is designed so that you can quickly locate maintenance information.

How to Use This Manual

1. Find the procedure or information you need in the Table of Contents or the Index.
2. Read the entire procedure before you do it.
3. Gather the parts and tools you will need.
4. Make sure you understand all safety notices before you start a task. Notes and notices are defined below.

Notes and Notices

For your safety and to protect valuable equipment, it is very important that you read and comply with all information highlighted under notes and notices:

DANGER:

The word Danger indicates the presence of a hazard that has the potential of causing death or serious personal injury. Danger and Caution notices are numbered to help you find the translated versions in the IBM 6400 Line Matrix Printer Safety Notices booklet.

CAUTION:

The word Caution indicates the presence of a hazard that has the potential of causing moderate or minor personal injury.

CAUTION:

This symbol indicates an assembly that requires two or more persons to lift or hold.

ATTENTION

Indicates the possibility of damage to a program, device, system, or data.

IMPORTANT

Information vital to proper operation of the printer.

NOTE: A note gives you helpful tips about printer operation and maintenance.

Printing Conventions in This Manual

- **Operator panel keys and indicators** are printed **bold**.

  Example: Press the **Cancel** key, then press the **Start** key.

- Liquid Crystal Display (LCD) messages are printed in capital letters inside quotation marks (“ ”).

  Example: Press the **Stop** key. “NOT READY” appears on the LCD.

- Key combinations are denoted by the **+** (plus) symbol.

  Example: Press **Scroll↑ + Scroll↑**
  means *Press the* **Scroll↑** *key and the* **Scroll↑** *key at the same time.*

Related Documents

To ensure complete understanding of important safety notices for technicians whose native language is not English, the notices have been translated into many languages in the *IBM 6400 Line Matrix Printer Safety Notices*: Form No. G544–5389.

This maintenance manual does not explain how to operate or configure the printer. For that information, refer to the *Operator’s Guide* and *Setup Guide*:

- *IBM 6400 Line Matrix Printer Operator’s Guide,* Form No. S544–5641
  Illustrated instructions on daily printer operation.
- *IBM 6400 Line Matrix Printer Setup Guide,* Form No. S544–5640
  Explains how to install and configure the printer.
- *Coax/Twinax Multi-Platform Interface Option Installation and Operation Guide*, Form Number S544–5642

Information pertaining to printer control languages, emulations, and control codes is in the applicable *Programmer’s Reference* manual:

- *IBM 6400 ASCII Programmer’s Reference*: Form No. S544–5635
- *IBM 6400 CTA Programmer’s Reference*: Form No. S544–5636
- *IBM 6400 IPDS Programmer’s Reference*: Form No. S544–5637

Information pertaining to graphics programming is in the applicable *User’s Manual*:

- *IBM 6400 Code V User's Manual:* Form No. S544–5638
  Provides information used with the optional Code V Printronix emulation enhancement feature. The Code V Printronix emulation allows the user to create and store forms, generate logos, bar codes, and expanded characters, create other graphics, and merge graphics with alphanumeric data as a document is printed.
- *IBM 6400 IGP User's Manual:* Form No. S544–5639
  Provides information used with the optional IGP Printronix emulation enhancement feature. The IGP Printronix emulation allows the user to create and store forms, generate logos, bar codes, and expanded characters, create other graphics, and merge graphics with alphanumeric data as a document is printed.

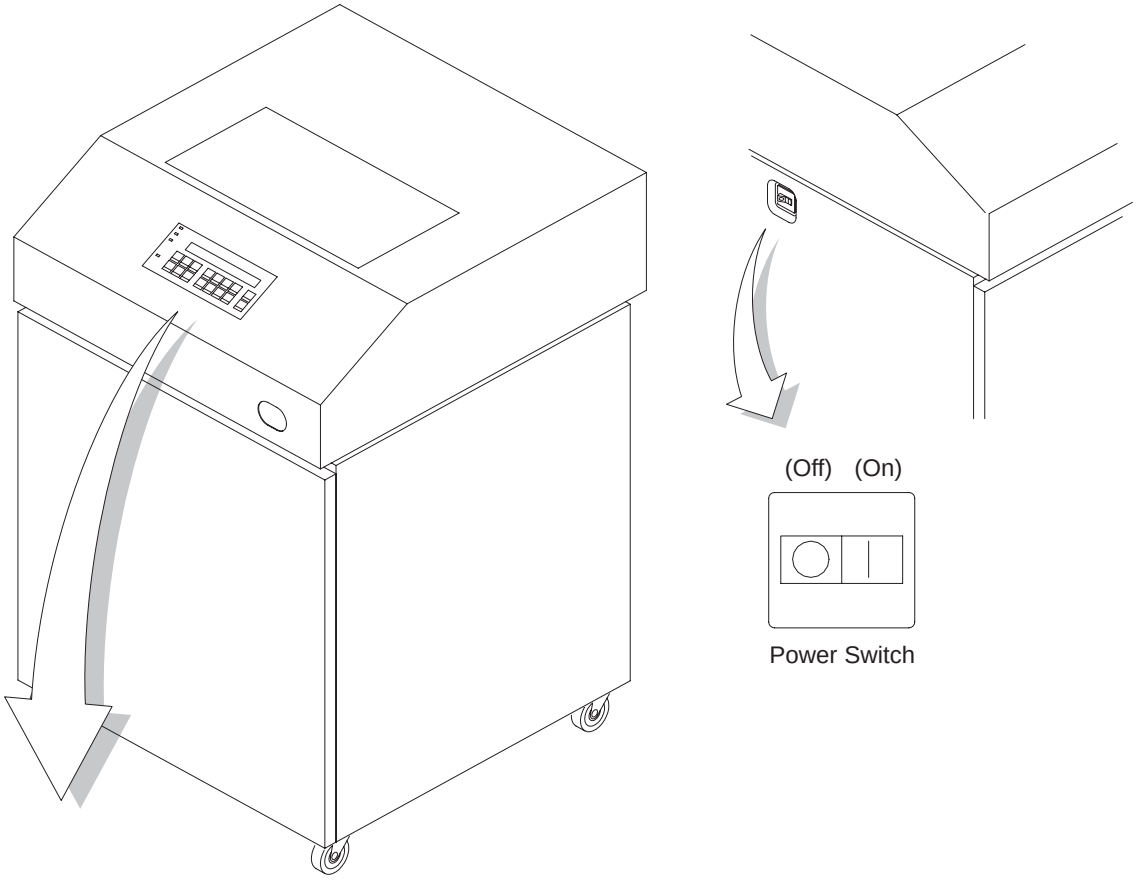
Installation, configuration, and troubleshooting of the Network Print Server are covered in the following documents:

- *Print Server User's Guide*,
  Part No. 30H4056
- *Ethernet** Interface User's Manual*
  Form No. S246–0153

Controls and Indicators

Electrical Controls and Indicators, Cabinet Models (Figure 2)

Key or Indicator	Function
Power Indicator	Lit when the printer is on.
Ready Indicator	Lit when the printer is in READY mode (on-line), no errors are pending, and the printer is ready to process data. Off when the printer is in NOT READY mode (off-line).
Processing Indicator	Flashes when the printer is receiving data from the host.
Attention Indicator	Flashes when an error occurs. After correcting the error, press Stop to turn off this LED.
Power Switch	Applies power to the printer: (1 = on, 0 = off.) This switch is also a circuit breaker.
LCD	The LCD (Liquid Crystal Display) displays printer status messages.
Start	Puts the printer in the READY (on-line) mode. This key also clears fault conditions, exits program mode menus, moves paper back to print position after View is pressed, and restores after an eject.
Stop	Puts the printer in the NOT READY (off-line) mode. This key also silences the audible alarm, stops a Printer Test, and restores after an eject. Stop + Enter resets the printer.
Form Feed	Advances paper to next Top-Of-Form, as defined by the current page length.
Set Top Of Form	Sets TOF and moves paper downward from the tractor alignment notches to the print position.
Line Feed	Moves paper up one line, as determined by current line spacing.
View	Press to move the current print position up to the tractor area for viewing. Press again to return paper to original print position.
Cancel	Cancels a print job.
Eject / Restore	Moves paper for viewing or tear-off. This key is configurable: refer to the *Operator's Guide*.
Menu	If in the NOT READY mode, this key puts the printer in the PROGRAM mode. If the configuration menus are locked, the LCD indicates the operator panel is locked.
Enter	Selects the option displayed on the LCD. This action either sets a value, moves to the next lower level of configuration, or starts a self-test. Stop + Enter resets the printer.
Return	Returns to the next higher level of a configuration menu.
Micro ↑	In the NOT READY mode, moves the paper upward 1/72 inch ("micro-step" function).
Micro ↓	In the NOT READY mode, moves the paper downward 1/72 inch ("micro-step" function).
Scroll ↑	In the PROGRAM mode, this key moves to the next menu ("Scroll" function).
Scroll ↓	In the PROGRAM mode, this key moves to the previous menu ("Scroll" function).
Printer Configuration	Prints the current configuration.
Stop + Enter	Soft reset: load power on configuration in memory. Printer must be in NOT READY mode.
Scroll ↑+ Scroll ↓	Toggles the lock on the configuration menus.



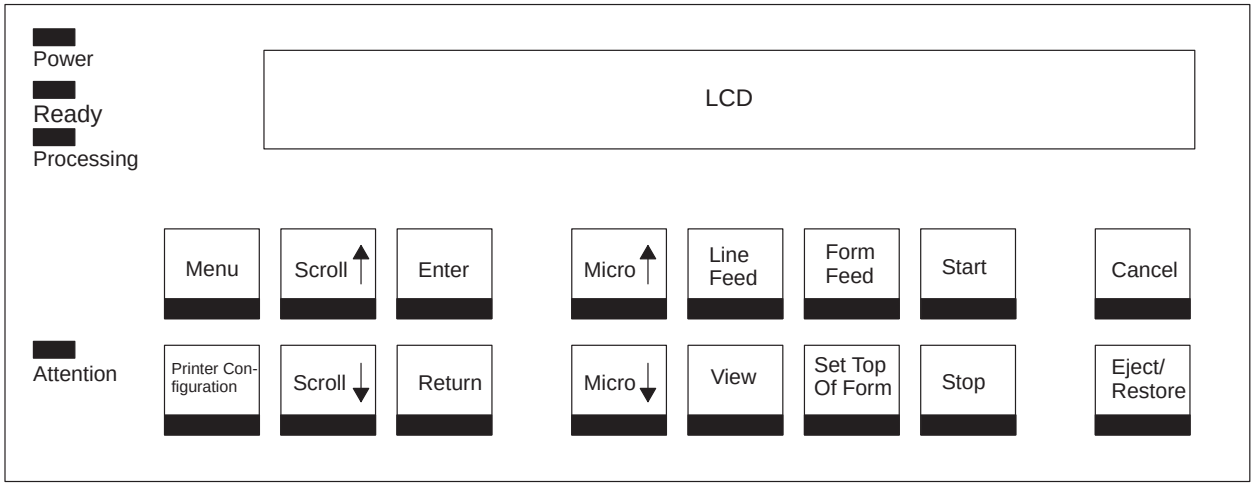


Figure 2. Electrical Controls and Indicators, Cabinet Models

Electrical Controls and Indicators, Pedestal Models (Figure 3)

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Set Top Of Form	Sets TOF and moves paper downward from the tractor alignment notches to the print position.
Line Feed	Moves paper up one line, as determined by current line spacing.
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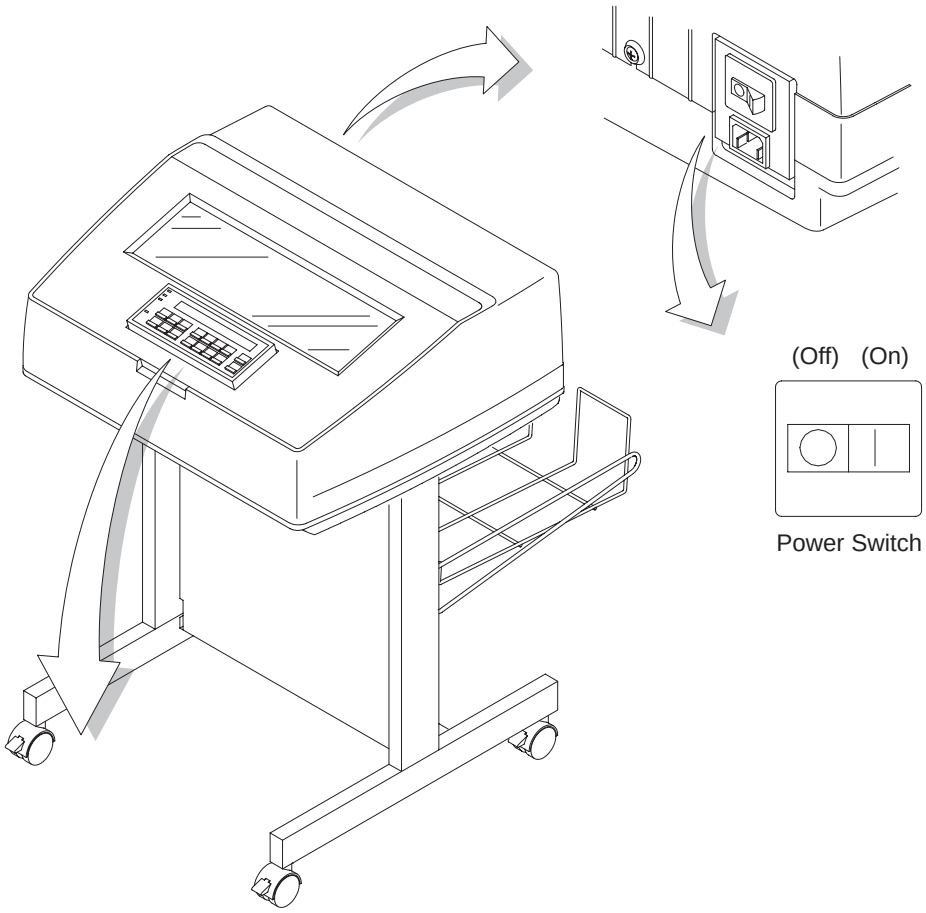
Printer Configuration	Prints the current configuration.
Stop + Enter	Soft reset: load power on configuration in memory. Printer must be in NOT READY mode.
Scroll ↑+ Scroll ↓	Toggles the lock on the configuration menus.



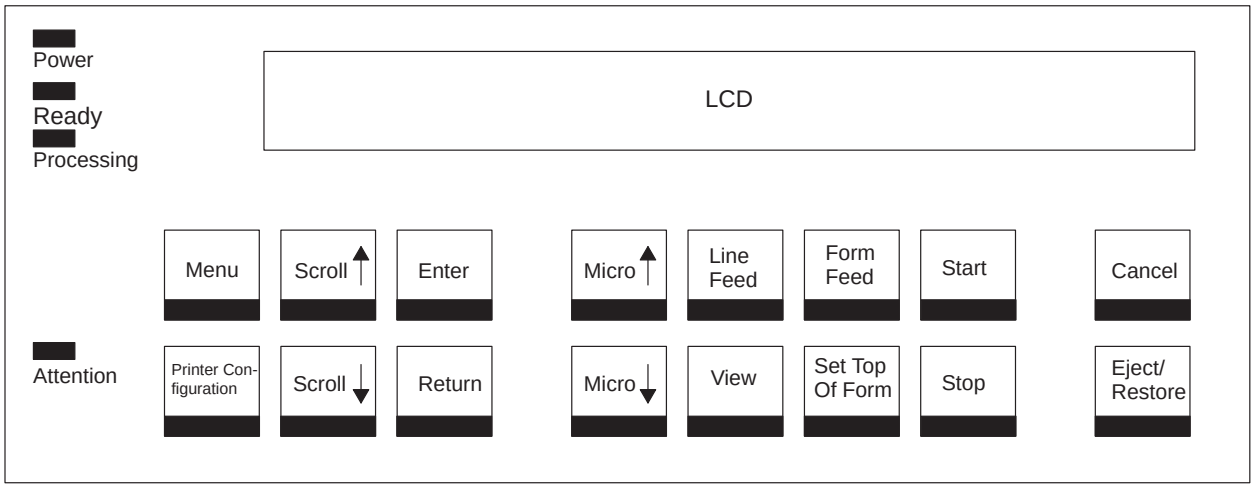
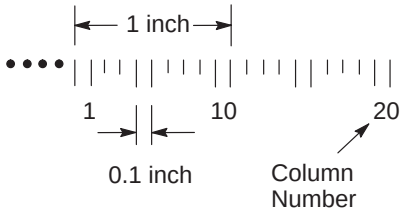


Figure 3. Electrical Controls and Indicators, Pedestal Model

Mechanical Controls and Indicators, All Models (Figure 4)

Control or Indicator	Function
Forms Thickness Lever	Sets the platen for paper and forms of different thicknesses. Lever must be fully opened (raised) to load or unload paper.
Paper Supports	Help prevent paper jams by supporting inner sections of paper. Positioned manually by sliding them along shafts.
Forms Thickness Pointer and Scale	Indicates *relative* thickness of forms/paper. Set this lever at A for thin (single-part) forms, B for thicker forms, and so on.
Tractors (2)	Hold and feed paper. Used to set side margin and position paper horizontally.
Tractor locks (2)	Lock tractors in position.
Horizontal Adjustment Knob	Allows fine positioning of left print margin. Moves paper and tractors left or right.
Vertical Position Knob	Used to set top of form or first line to be printed. Rotate to move paper vertically. Works when Forms Thickness Lever is open.
Ribbon Loading Path Diagrams	Instructions showing how to load the ribbon correctly. One diagram is cast in relief on the shuttle cover, and another is printed on the paper scale.
Paper Scale	A horizontal scale graduated in tenths of an inch, useful for setting paper margins and counting text columns. (See below.) 

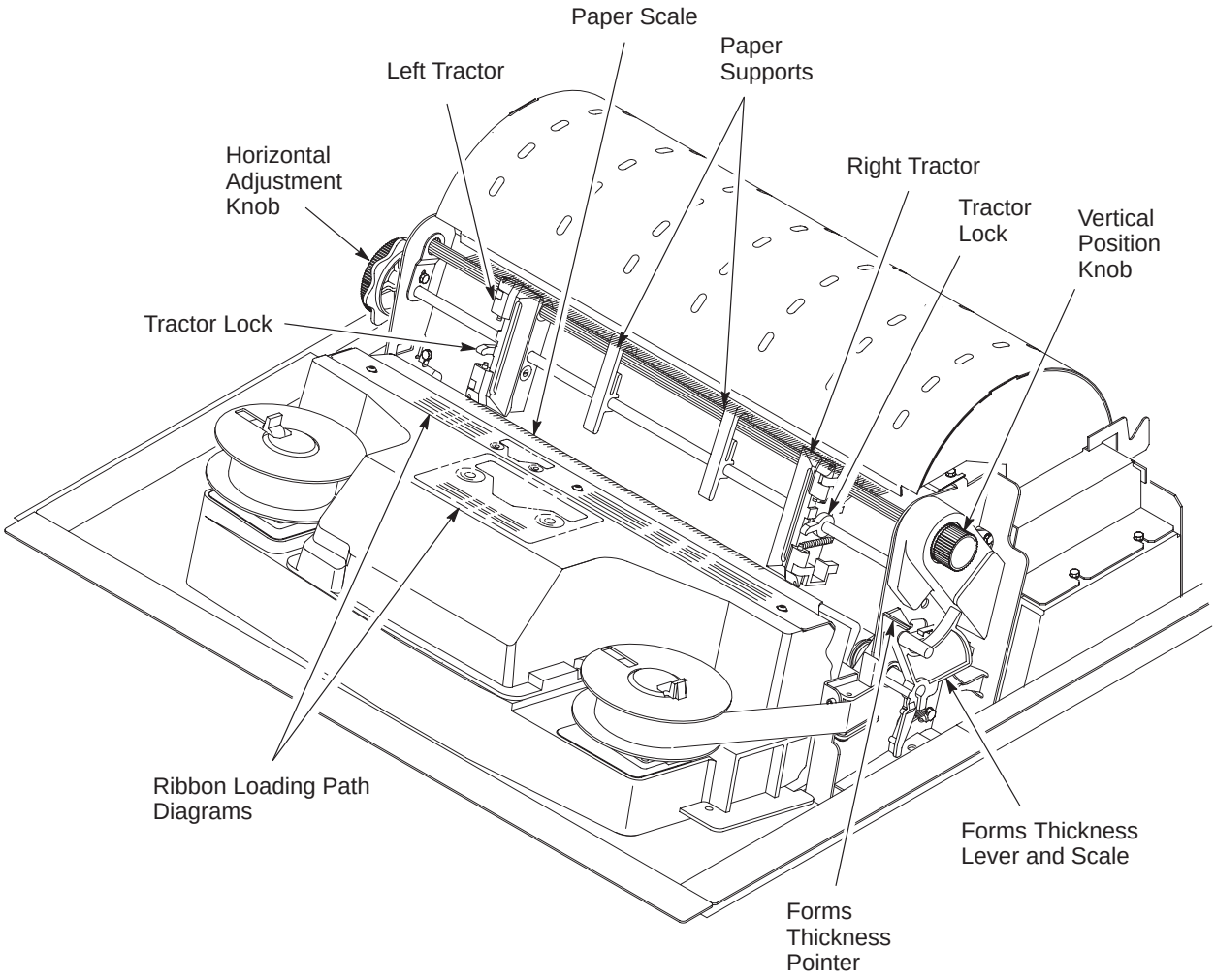


Figure 4. Mechanical Controls and Indicators

Tools, Test Equipment, and Supplies

The tools and equipment required for field level maintenance of the printer are listed below.

Item	Part No.
6400 Line Matrix Printer Configuration Utility Disk	63H7379
1–30 Inch-pound Torque Screwdriver	16F1661
ESD Wrist Strap	6405959
Feeler Gauge, .010 inch	
Feeler Gauge, .011 inch	
Feeler Gauge, .040 inch	
Force Gauge, 20 lb	25F9687
Grip Ring Pliers	9900317
Lubricant, Bearing, IBM #20	117397
DIP Module Extracting Tool	9900764
Nut Driver, 1/4 inch	
Nut Driver, 5/16 inch	
Open End Wrench, 7/32 inch	1650843
Open End Wrench, 5/16 inch	9900005
PLCC Module Pick Extraction Tool	73G5523
PLCC Module Plier Extraction Tool	10G3902
Screwdriver, Philips, #1	73G5362
Screwdriver, Philips, #2	73G5363
Spring Hook, Heavy Duty	
Tie Wraps	75X5972
Torque Screwdriver Adapter	39F8449
Torque Screwdriver Hex Adapter 3/32 inch	39F8451
Torque Screwdriver Hex Adapter 5/32 inch	39F8450
Torque Screwdriver Hex Adapter 3/16 inch	39F8455
Torque Screwdriver Hex Adapter 5/64 inch	16F1663
Torx** T-10 Bit	83F2834

2 Installation

Installation and configuration of the printer are covered in the *6400 Line Matrix Printer Set-Up Guide*, Form No. S544–5640

Installation, operation, and replacement parts for the optional coax/twinax interface are covered in the *Coax/Twinax Multi–Platform Interface Option Installation and Operation Guide*, Form No. S246–0149.

Installation, configuration, and troubleshooting of the Network Print Server are covered in the following documents:

- *IBM Network Print Server Ethernet Administrator's Guide*, Form No. S246–0111
- *IBM Network Print Server Token-Ring Administrator's Guide*, Form No. S246–0112
- The *Network Print Server Technical Reference Manual* is included on a diskette that comes with the Network Print Server. This "softcopy" document is in Adobe Acrobat Reader format.

3 Preventive Maintenance

Cleaning the Printer

Aside from normal replenishment of paper and ribbons, the only preventive maintenance required for the printer is periodic cleaning.

Because operating conditions vary widely, the user must determine how often to clean the printer.

There is no guarantee that the user will clean the printer regularly, however, so you should clean the printer whenever you are called to service it.

DANGER:

<2> Switch off printer power and unplug the printer power cord before cleaning the printer.

ATTENTION

Do not use abrasive cleaners, particularly on the window.
Do not drip water into the printer. Damage to the equipment will result.
Do not spray directly onto the printer when using spray solutions (spray the cloth, then apply the dampened cloth to the printer).
Do not vacuum circuit boards.

Cleaning the Exterior

1. Power off the printer.
2. Disconnect the AC power cord from the power source.
3. Wipe the outside of the enclosure with a clean, lint-free cloth dampened (not wet) with water and a mild detergent or window cleaning solution.
4. Dry the enclosure with a clean, lint-free cloth.
5. Clean the inside of the printer, as described below.

Cleaning the Interior

1. Power off the printer.
2. Disconnect the AC power cord from the power source.
3. Open the printer cover.
4. Remove paper from the printer.
5. Remove the ribbon.
6. Using a soft-bristled, non-metallic brush, wipe paper dust and ribbon lint off the tractors, shuttle cover assembly, base casting, and ribbon guides. Vacuum up the residue.
7. Wipe the splined shaft and the ribbon guides with a soft cloth.
8. Vacuum up dust or residue that has accumulated inside the lower cabinet.
9. Wipe the interior of the lower cabinet with a clean, lint-free cloth dampened with water and a mild detergent or window cleaning solution.
10. Dry the cabinet interior with a clean, lint-free cloth.
11. Clean the shuttle frame assembly, as described below.

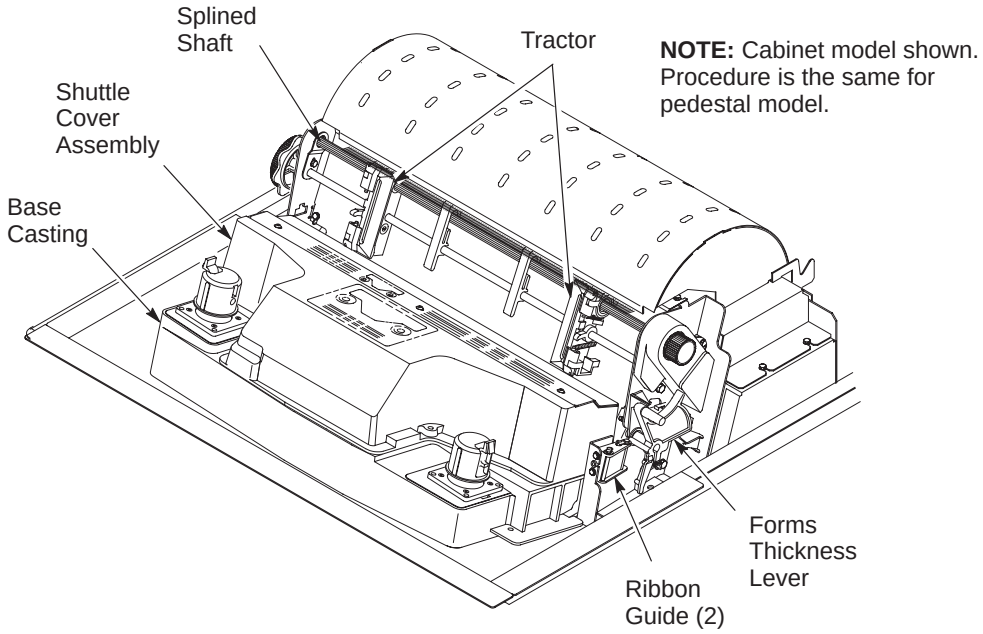


Figure 5. Cleaning Inside the Cabinet or Top Cover

Cleaning the Shuttle Frame Assembly

1. Remove the shuttle cover assembly (page 209).
2. Remove the shuttle frame assembly (page 249).
3. Remove the paper ironer (page 236).

CAUTION:

<2> Over time the upper edge of the paper ironer can become sharp. To avoid cutting yourself handle the paper ironer on the sides.

4. Wipe the paper ironer with a soft cloth to remove lint, ink, and paper residue.
5. Install the paper ironer (page 236).
6. Remove the hammer bank / ribbon mask cover assembly (page 206).

ATTENTION

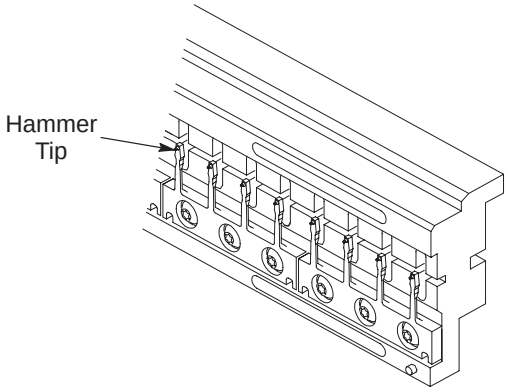
The thin plate (ribbon mask) of the hammer bank cover assembly is fragile. Be careful not to over-bend or kink the ribbon mask when handling and cleaning the hammer bank cover assembly.

7. Using a clean soft cloth, wipe the hammer bank cover and ribbon mask to remove lint, ink, and paper residue. Clean the holes in the cover strips. Carefully wipe between the hammer bank cover and the ribbon mask (early models).

ATTENTION

Do not use any solvents or liquids to clean the hammer tips. Clean the hammer tips gently—too much pressure can chip hammer tips.

8. Using a stiff, non-metallic brush (such as a toothbrush), gently brush the hammer tips to remove lint and ink accumulations. (See Figure 6.) Vacuum up any residue.



NOTE: 6400–004/04P hammer bank shown. Procedure is the same for all hammer banks.

Figure 6. Cleaning the Hammer Tips

ATTENTION

The hammer bank contains a strong magnet. To prevent damage to the hammer tips, do not let the hammer bank cover assembly snap into place as the hammer bank magnet attracts it. Any impact of the cover against the hammer bank can break hammer tips.

9. Install the hammer bank / ribbon mask cover assembly (page 206).
10. Install the shuttle frame assembly (page 249).
11. Install the shuttle cover assembly (page 209).
12. Clean the card cage fan assembly, as described below.

Cleaning the Card Cage Fan Assembly

1. Cabinet Models: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
2. Vacuum the card cage fan assembly and surrounding areas to remove paper particles, dust, and lint.
3. Cabinet Models: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).
4. Close the printer cover.
5. Connect the AC power cord to the power source.

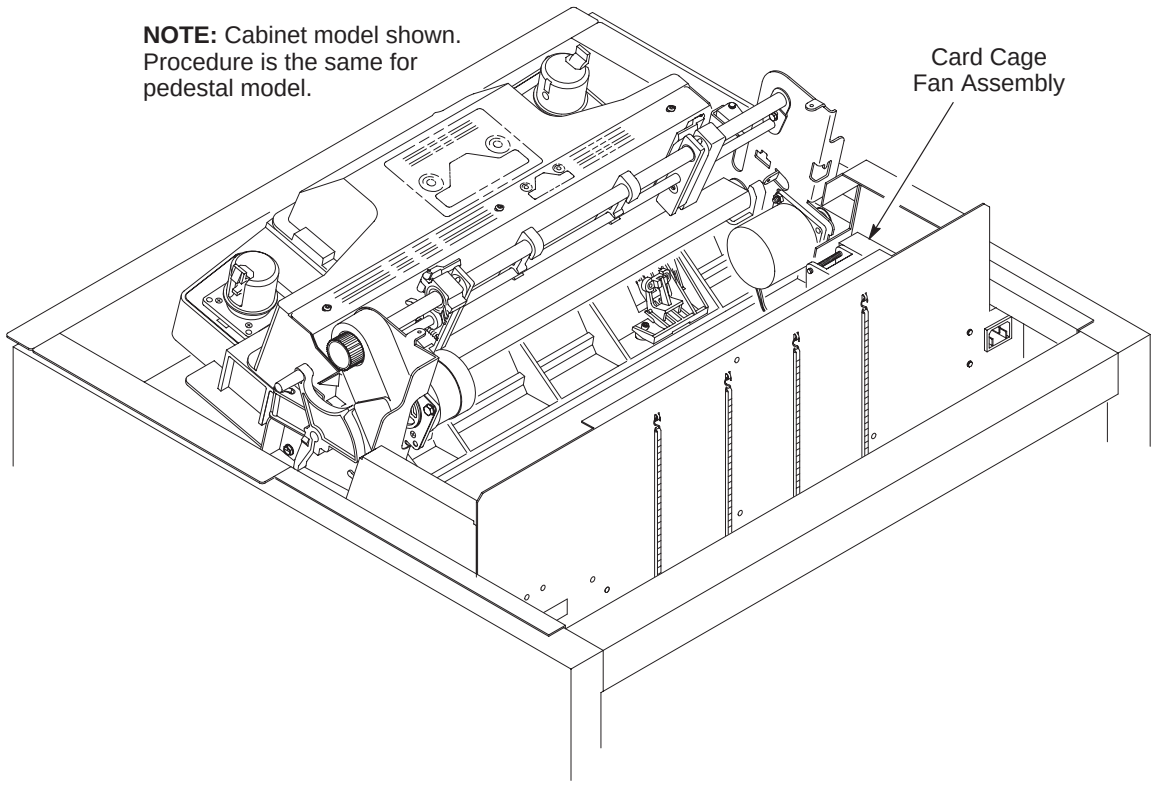


Figure 7. Cleaning the Card Cage Fan Assembly

4 Principles of Operation

Line Matrix Printing

The printer creates characters and graphics by printing patterns of ink dots on paper, an entire line at a time. This technique is called line matrix printing.

Every text character is stored in printer memory as a pattern of dots on a logical grid called the dot matrix. (See Figure 8.) The ink dots are made by a row of small hammers mounted on a shuttle that sweeps rapidly back and forth. Printer logic circuits divide every line of incoming data into horizontal dot rows. The hammers put dots at the required positions for the entire line by striking an inked ribbon and the paper.

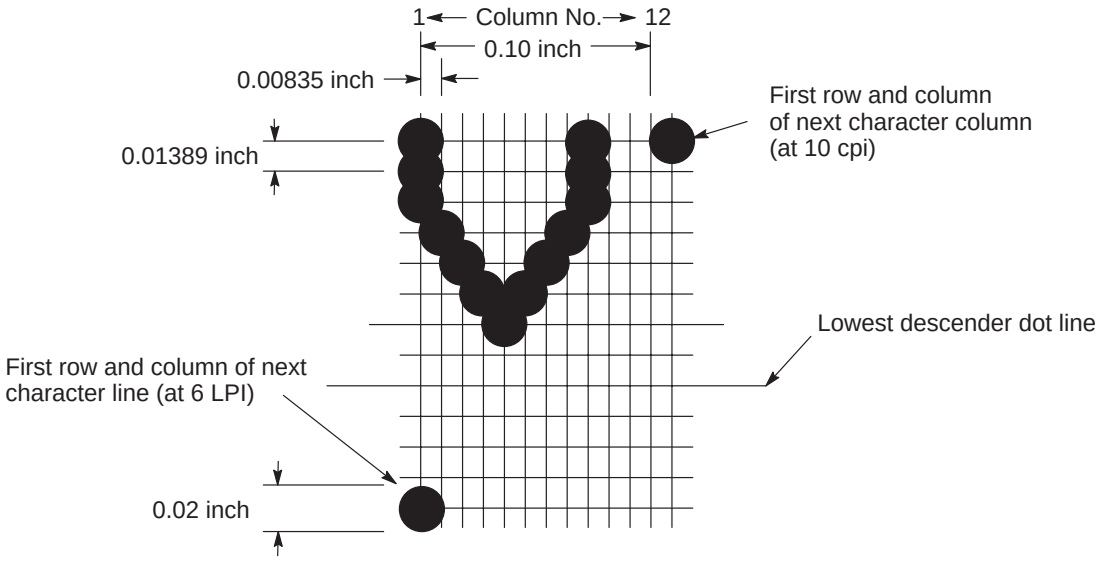


Figure 8. A Dot Matrix

When the shuttle reaches the end of a sweep, it reverses direction, the paper is advanced one dot row, and the hammers print the next row of dots as the shuttle sweeps in the opposite direction. After a line of characters is printed, hammer action stops and the paper advances to the first dot row of the next print line. The number of dot rows allowed for line separation depends on the vertical line spacing the user selects.

The dot matrix patterns of text characters vary according to the font the user selects. For example, in the data processing (DP) font at a line spacing of six lines per inch (lpi), a dot matrix contains 12 dot rows from the top of one character line to the top of the next. (See Figure 8 and Figure 9.) At eight lpi there are nine dot rows per character line, at nine lpi eight dot rows per character line, and so on.

Each individual hammer spring forms more than one character as the shuttle moves horizontally. This principle is illustrated in Figure 10.

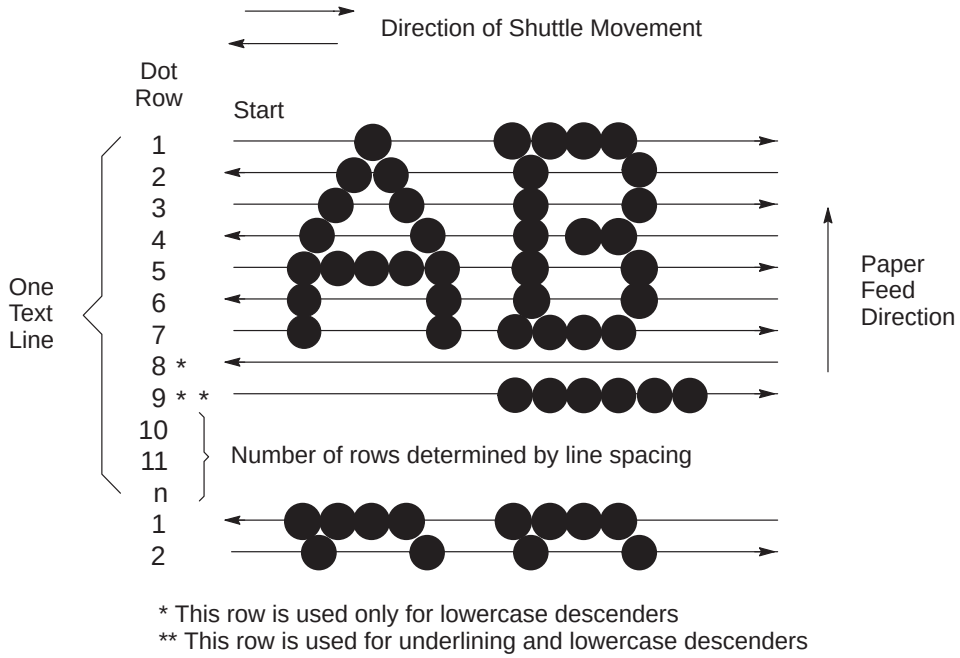
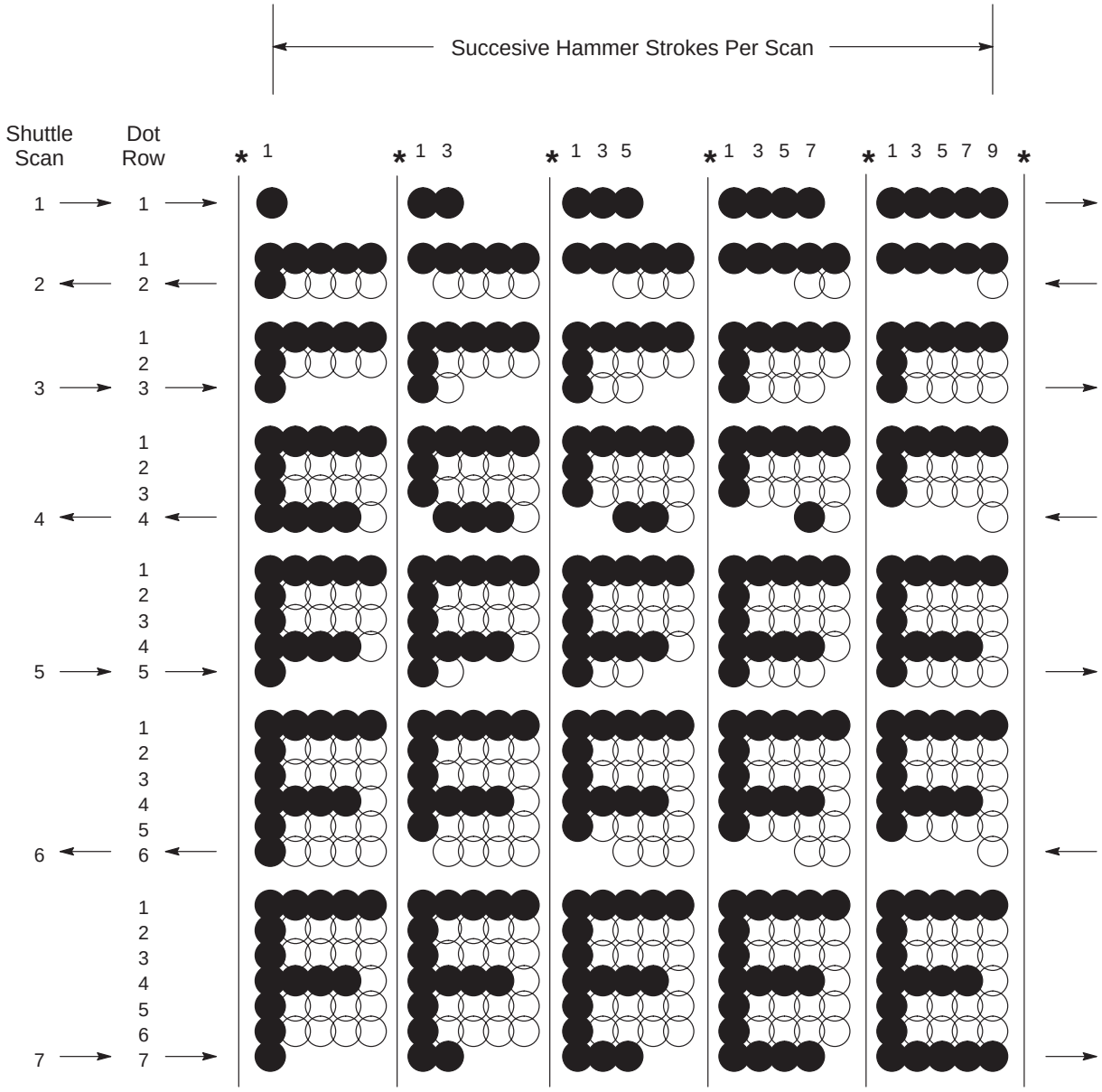


Figure 9. Standard Character Formation



* Even column dot centers within the printed character area and character space hammer positions are not illustrated in this diagram.

NOTE: ● = Hammer Released and Dot Printed

○ = Hammer Not Released; No Dot Printed

Figure 10. Action of One Hammer Spring in Text Printing

Printing Mechanism

While the principles of line matrix printing are easy to state, the act of printing dots accurately from a rapidly oscillating shuttle onto a vertically moving piece of paper requires complex timing and coordination between printer logic and the printing mechanism. The printing mechanism consists of the shuttle frame assembly, the ribbon transport system, and the paper transport system.

Shuttle Frame Assembly

The central element of the printing mechanism is the shuttle frame assembly, which houses the hammer bank assembly and the shuttle drive motor. (See Figure 11.)

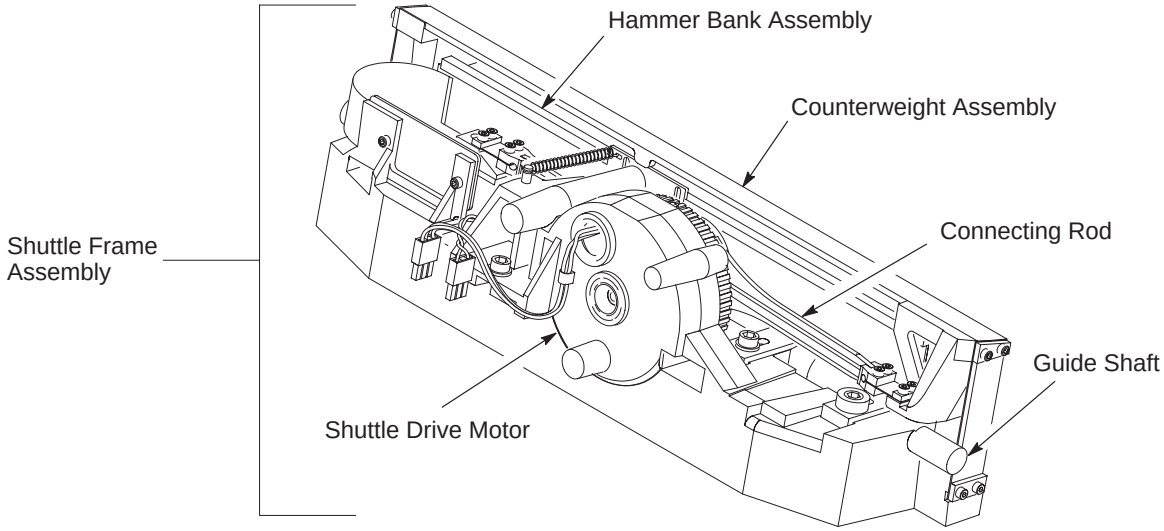


Figure 11. Shuttle Frame Assembly

Hammer Bank Assembly

The hammer springs are grouped in comb-like assemblies mounted on a solid hammer bank. Both the number of hammer springs per hammer spring assembly and the number of hammer spring assemblies on the hammer bank vary according to printer model:

- 6400–004/–04P/–005/–05P/–050/–P50: seven 4-hammer assemblies, for a total of 28 hammer springs
- 6400–008/–08P/009/–09P: seven 7-hammer assemblies, for a total of 49 hammer springs
- 6400–010, –10P: six 10-hammer assemblies, for a total of 60 hammer springs
- 6400–012/–014: seven 13-hammer assemblies, for a total of 91 hammer springs
- 6400–015: six 17-hammer assemblies, for a total of 102 hammer springs

Shuttle Drive Motor

The shuttle drive motor is built into the shuttle assembly casting and drives two connecting rods on a crankshaft. (See Figure 11.) The small end of one connecting rod attaches to the hammer bank; the small end of the other connecting rod attaches to a counterweight frame surrounding the hammer bank. (The hammer bank and the counterweight constitute the shuttle assembly.) The rotary motion of the shuttle drive motor converts to linear and opposing motion of the hammer bank assembly and the counterweight, in an arrangement similar to that of a horizontally-opposed gasoline engine. Mechanically, this design achieves the same benefits as this type of engine: perfect primary balance, low vibration, and durability.

Each hammer spring is a stiff leaf spring with a cylindrical tungsten carbide tip on the free end. (See Figure 12.) A permanent magnet is imbedded along the length of the hammer bank and acts on the hammer springs through individual pole pieces. The pole pieces magnetically attract and hold the free end of the hammer spring under tension. This is called the retracted state.

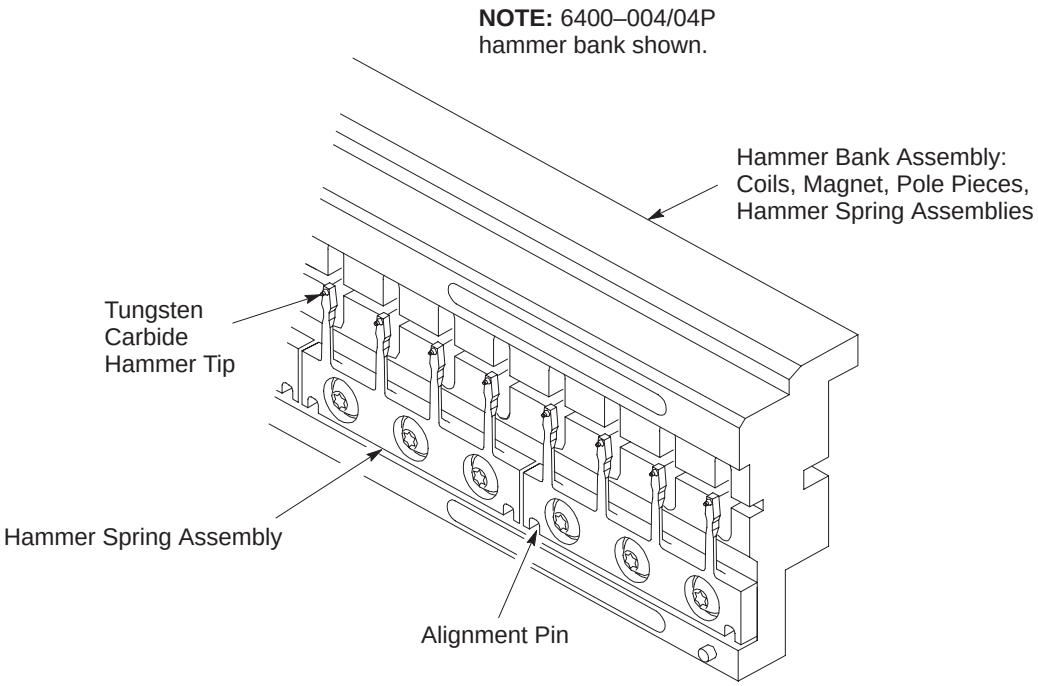


Figure 12. Hammer Springs and Hammer Bank (Detail)

Two electromagnetic coils are mounted behind each hammer and wound around each pole piece. The coils are normally de-energized. When hammer driver logic determines that the hammer must print a dot, a current pulse energizes the coils. The polarity of the resulting magnetic field opposes the field of the permanent magnet, canceling its effect and releasing the hammer. The hammer springs forward, strikes the ribbon and paper, and leaves a dot impression of the hammer tip on the paper.

While the hammer is in flight the coil is de-energized and its field collapses. After striking the ribbon and paper, the hammer rebounds and the permanent magnet recaptures it. When the shuttle reaches the end of a sweep, it reverses direction, the paper is moved up one dot row, and the hammer springs print the next row of dots as the shuttle sweeps in the opposite direction.

Paper Transport System

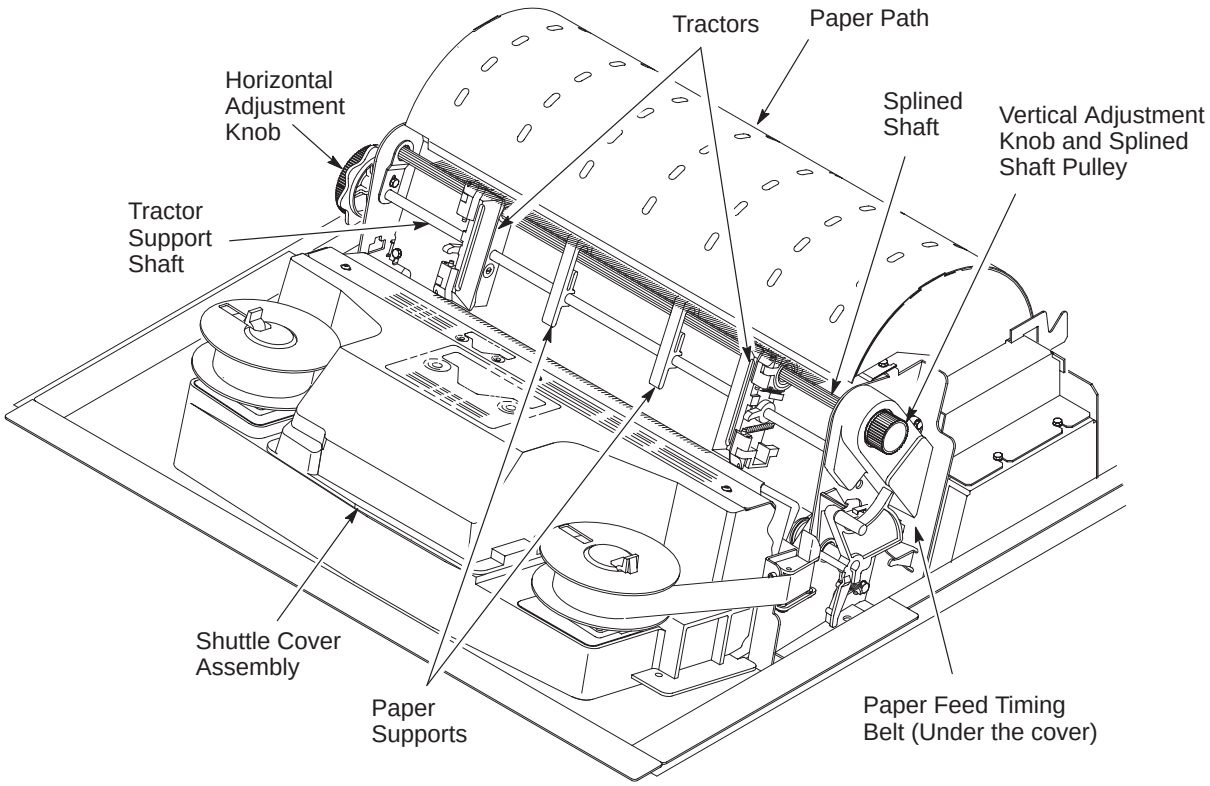


Figure 13. Paper Transport System

A two-phase DC stepper motor, directed by the EC on the controller board, drives two tractor sprockets by means of a toothed belt and splined shaft pulley arrangement. The stepper motor permits extremely accurate incremental vertical paper movement. This drive configuration is designed for continuous, fan-folded paper three to 17 inches wide and one to six sheets thick. For reverse paper feeding, the platen open motor opens and closes the platen via a toothed belt. Opening the platen prevents paper jams when paper direction is reversed—that is, paper is moved downwards—in order to view the print area, set top of form, or allow applications to overprint forms.

Paper is positioned horizontally using the tractors and the horizontal adjustment knob. Each tractor engages paper perforations with six sprocket pins and locks in place with a friction lock. The horizontal adjustment knob allows vernier positioning of the left print margin.

Paper can be positioned vertically by hand with the vertical adjustment knob.

Ribbon Transport System

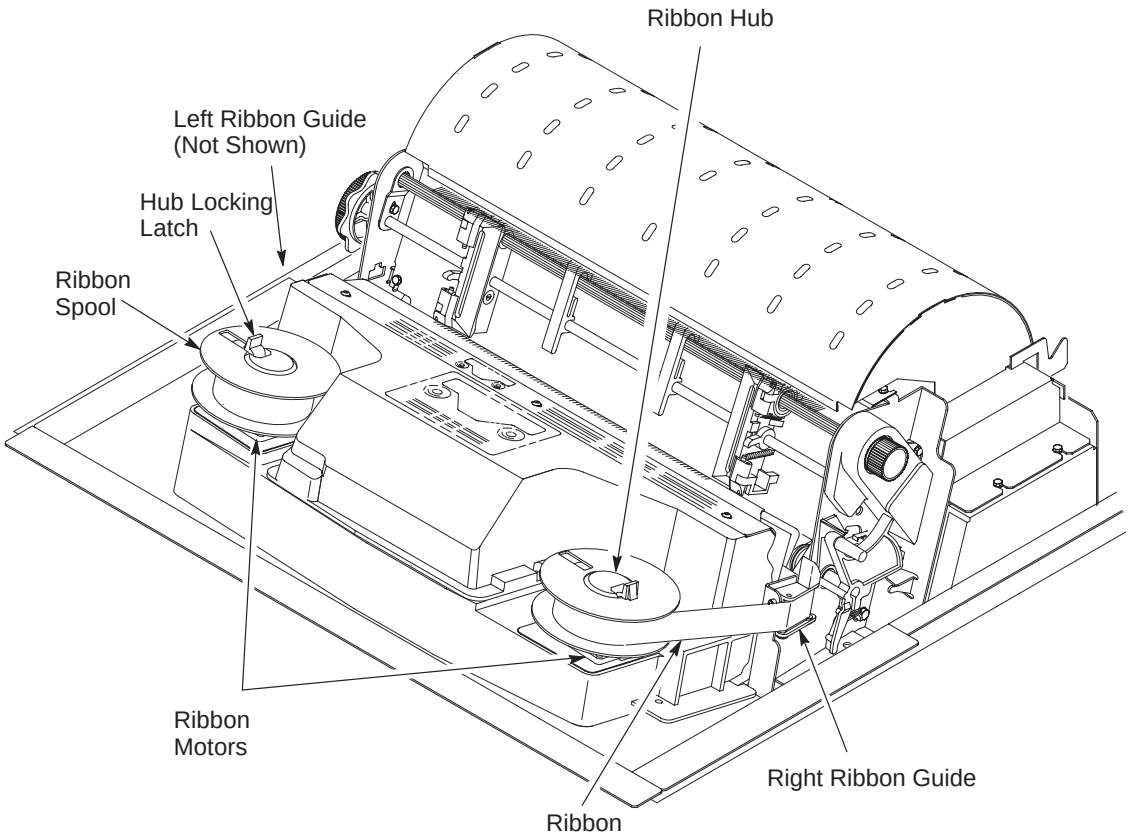


Figure 14. Ribbon Transport System

An inked ribbon winds and unwinds continuously on a pair of spools latched to hubs that are driven by the ribbon motors. The hubs and spools are offset vertically to equalize ribbon wear and prolong ribbon life. The ribbon motors operate only when the shuttle assembly is moving. Ribbon motion reverses when a metal strip at either end of the ribbon crosses the left or right ribbon guide, completing a circuit that causes both motors to reverse direction.

Constant ribbon tension is maintained by controlling each motor with a drive or drag circuit. While the shuttle assembly is in motion, one motor acts as a drive motor, pulling the ribbon against the resistance exerted by the other motor—the drag motor. This system maintains a constant motor speed and ribbon tension.

Logical Control of the Printer

The printer is divided into four functional elements: the operator panel, the CMX controller board, the power supply, and the print mechanism. See Figure 15.

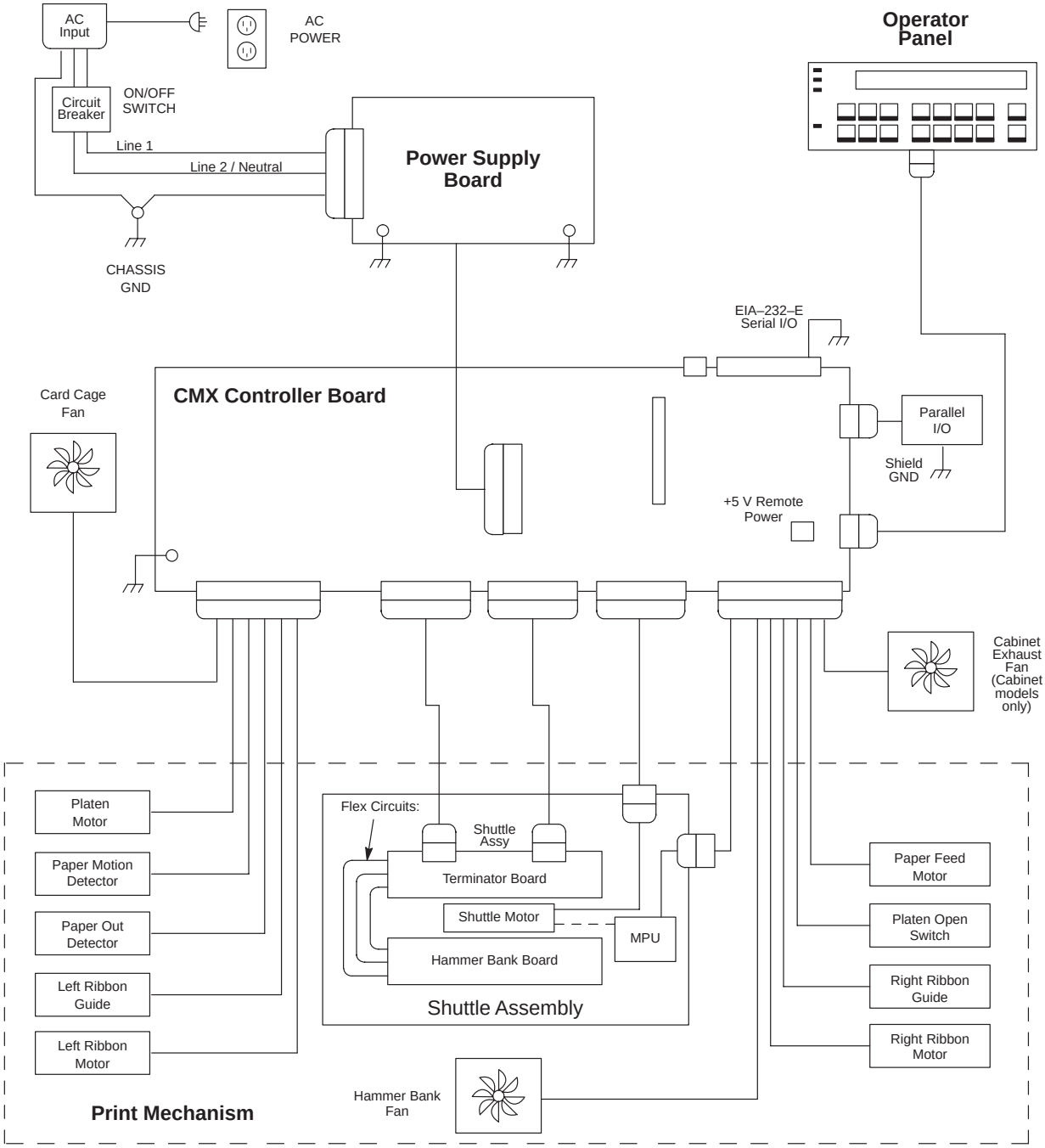


Figure 15. Functional Elements of the Printer

Operator Panel

The user communicates with the printer by pressing keys on the operator panel. The keys are momentary contact switches. The operator panel processes and sends key closure information to the controller board and displays information from the controller on the LCD. A status indicator next to the LCD also conveys printer status information to the user.

The LCD, status indicator, and keys are mounted on a printed circuit board assembly enclosed in a protective housing.

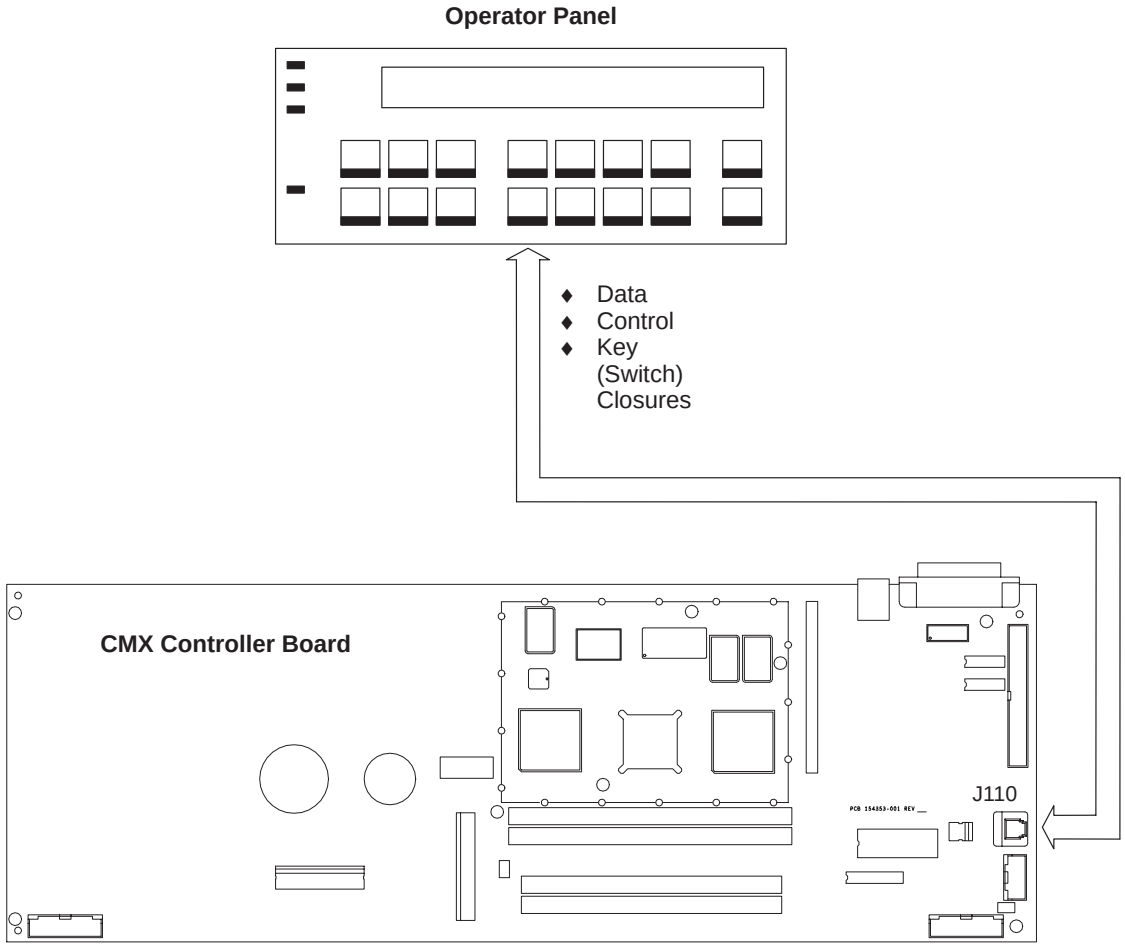


Figure 16. Operator Panel Functional Overview

CMX Controller Board

The heart of the printer is the CMX controller board, which monitors and directs all printer functions. The controller board receives and processes all data from the host computer, builds the printable images, controls all motors, and drives the hammer springs. Except for the power supply and final hammer drive circuits, all logic and drive circuitry for the printer are contained on the controller board.

The CMX controller board consists of two functional units: the Data Controller (DC) and the Engine Controller (EC).

The DC is responsible for:

- Host I/O
- Operator I/O
- Security Interface
- Print Image Generation
- Overall High Level (Logical) Control

The EC is responsible for:

- Print Mechanism Operation
- Print Mechanism Fault Monitoring
- Power Shutdown/Power Saving Modes

The EC and DC communicate through semaphore registers. The DC receives host and operator input and returns dot images and LCD messages to buffers in memory. Image data are passed to the EC upon request, are processed, then sent to the hammer bank. The EC synchronizes paper, ribbon, platen, and shuttle motion as it feeds dot data to the hammer drivers. Figure 17 summarizes this architecture.

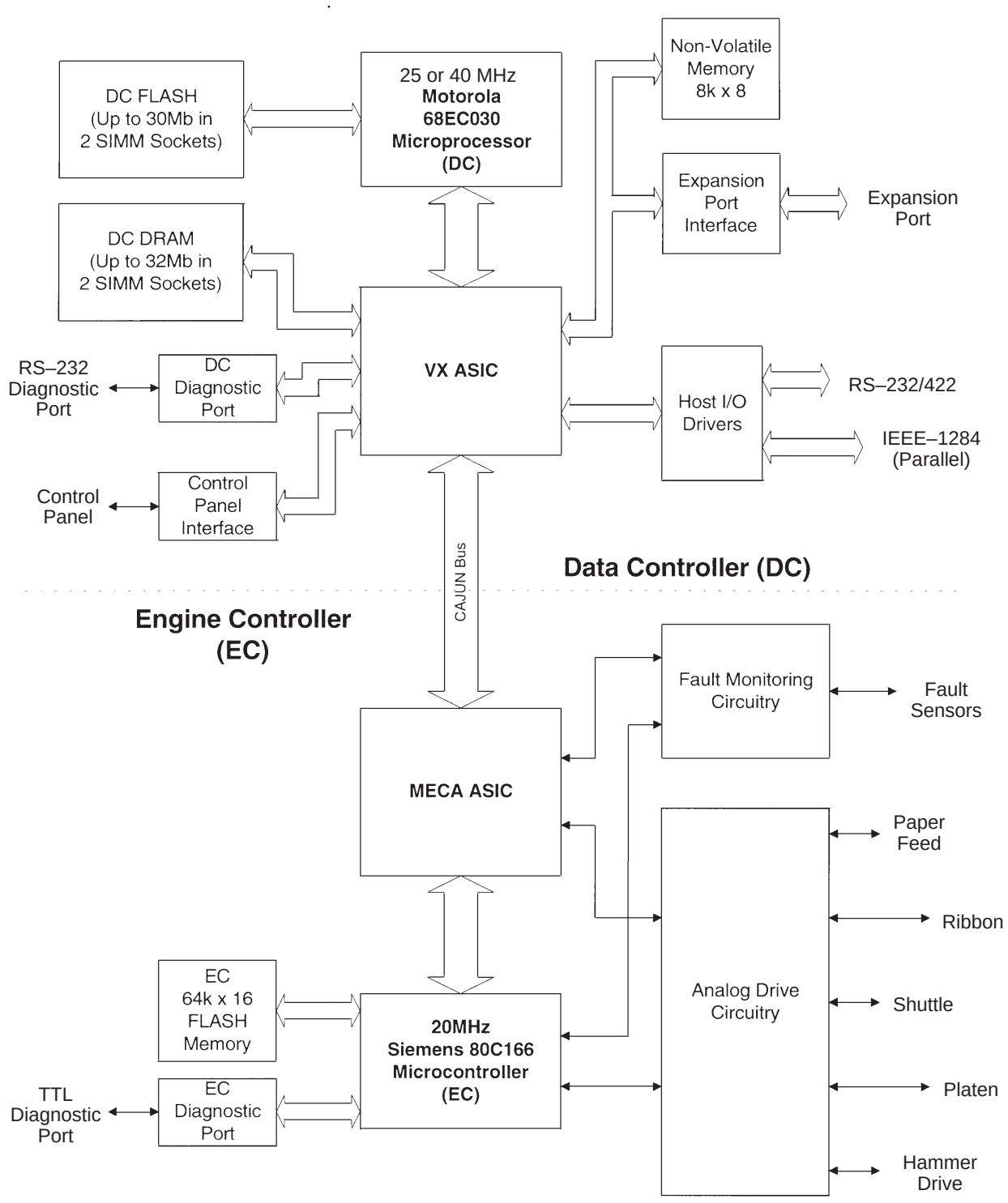


Figure 17. CMX Controller Board Block Diagram

Data Controller

The data controller (DC) consists of the following elements:

- 68EC030 microprocessor
- Two flash SIMM sockets, used for up to 30MB of program memory (Base configuration: 1MB flash in bank 0)
- Two DRAM SIMM sockets, used for up to 32MB of data memory (Base configuration: 1MB DRAM in bank 0)
- 8K x 8 Non-Volatile Battery-Backed static RAM (NVRAM) for storage of configuration and system statistical data
- VX ASIC (Application-Specific Integrated Circuit)
- Host I/O Drivers/Termination

68EC030 Microprocessor

A Motorola 68EC030 microprocessor serves as the processor of the DC unit. This processor runs at 25 MHz on all models except the 6400–050, –P50, –010, –P10, and –015.

On 6400–050, –P50, –010, –P10, and –015 printers the 68EC030 processor runs at 40 MHz and the controller board on these models is called the “CMX 040.” The CMX 040 controller is backward compatible with any 6400 Series printer, but must be used in 6400–050, –P50, –010, –P10, and –015 printers.

Although this chapter refers to the DC microprocessor as simply the “030,” remember that two different clock speeds are available.

Flash Memory

The DC stores program and emulation code in flash memory. Flash memory is erasable, non-volatile, and significantly faster than a disk drive.

The DC uses AMD 5.0V-only flash memory, which does not require higher programming and erasing voltages on the board (it has an internal charge pump to make these voltages itself). This memory supports at least 100,000 write/erase cycles. The flash memory is 32 bits wide. It is byte, word, and double word readable, but is always written as double words.

Two 80-pin SIMM sockets are provided for flash memory. Up to 30MB of flash (total), organized as up to four banks, may be installed in the two sockets on the controller board. The boot code for the 68EC030 processor must reside in bank 0.

Programs stored in flash memory are changed through the parallel or serial port.

DRAM

System DRAM is used for program variables, image buffers, and input buffers. All DRAM supports page mode operation and is addressable by individual byte.

Two standard 72-pin DRAM SIMMs are used for expansion memory. The DC, through the VX ASIC, may address up to 32MB of DRAM in four banks.

NVRAM

A 8K x 8 bit Non-Volatile battery-backed static RAM (NVRAM) device provides for the storage of configuration and system statistical data.

VX ASIC

The VX is a multifunction custom gate array ASIC containing all the logic for the DC that is not contained in the 68EC030 processor. The VX provides the following services:

- Memory Access Controller
- DRAM Controller
- Flash Controller
- Two DMA Channels
- Operator Panel Interface
- “Dot Plucking” and Adjacent Dot Checking
- “Cajun” Bus Interface
- Host I/O and Diagnostic Port

Memory Access Controller All 030 addresses go through the VX ASIC. The VX handles all address decoding, chip selects, DTACKs, and so on.

DRAM Controller The VX supports up to four banks of page mode DRAM.

FLASH Controller The VX supports up to four banks of flash memory.

DMA Channels The VX provides two channels for direct memory access. These channels move data from the host interface or expansion bus to the DRAM and vice versa. One address is an I/O address, the other is a memory address with auto-increment.

Operator Panel Interface The VX operator panel interface consists of five lines: serial clock, serial data, and three select lines. It is the VX that handles all parallel-to-serial (and vice versa) conversion to and from the panel, as well as any special timing needed when toggling select lines, etc.

“Dot Plucking” and Adjacent Dot Checking “Dot Plucking” is a specialized DMA function that removes dot data from a dot image buffer in DRAM in a programmable manner, serializes it, and sends it to the hammer bank. This function is actually controlled by the EC (see page 50), which has access to the VX through the “Cajun” Bus Interface.

“Cajun” Bus Interface The “Cajun” bus interfaces the DC, the EC, and the expansion port. The EC uses this bus to access DC resources, including the semaphore registers. (The semaphore registers are the primary communications path between the EC and DC.)

Ports The VX ASIC controls the following I/O functions:

- Interface to an IEEE 1284 Level 2 host
- Interface to RS–232E serial host
- Interface to RS–422 serial host

All the circuitry required for these host types is provided on the CMX board, except for the drivers themselves, ESD protection, and terminations.

Host I/O Drivers and Termination

Beyond the 030 processor and VX ASIC, additional support circuitry completes the serial and parallel interfaces. These circuits include:

- RS–232 drivers and receivers. These circuits use internal charge pumps to eliminate the need for ±12V power.
- RS–422 differential drivers and receivers
- Parallel port pull up and pull down terminating resistors are DIP-socketed for easy removal and installation.

All interface ICs and terminations have the following characteristics:

- Provide ESD protection to 15KV for all inputs.
- Less than 0.05V common mode ripple, measured at the power and ground of the interface ICs.
- Less than 0.02V common mode ripple, measured between chassis ground and the ground pins of the interface ICs.
- Greater than 200V/μs slew rate for all outputs.

Engine Controller

The engine controller (EC) consists of four main elements:

- 80C166 Microcontroller
- 128KB 5.0V-only FLASH program memory, organized as 64K x 16 bits. This memory is not expandable.
- MECA (Mechanism Engine Control ASIC)
- Analog drive circuitry

80C166 Microprocessor

The Siemens SAB 80C166 is a high-integration microcontroller. It has many features that suit it extremely well to real-time control applications. This controller and the MECA ASIC provide the functionality of three separate processors used in earlier controller board architectures. In this manual, the 80C166 is referred to as either the EC or the 166.

The 166 used on the CMX board runs at 20MHz and is housed in a 100-pin metric rectangular flat pack.

Bus Configuration The 166 bus is configured for 18-bit address, 16-bit data, non-multiplexed and segmented operation. The flash memory runs with zero wait states. An external PAL is used for address decoding.

Power Reduction The 166 chip has two power reduction modes: idle and Energy Star. Idle mode is not used. In Energy Star mode, +48V and all motors are de-energized, but the 166 operates as normal.

EC Flash Memory The EC stores all boot code, program code, and tables in its own local flash memory. This flash is organized as 64K x16 bits and uses the same technology as the DC flash: it is + 5.0V-only and is rated for a minimum of 100,000 write/erase cycles. EC memory is fixed; it is soldered to the controller board. Its contents can be updated through the DC (through the serial or parallel ports). At run time, the EC also stores tables in shared DRAM, which is accessed through the Cajun bus.

MECA ASIC The 166 uses numerous counters, PWM generators, and FIFOs in the MECA to control many printer motor functions. The MECA is a custom gate array, specifically designed to drive this system.

Analog Drive Circuitry

The analog drive functions convert 48 and 8.5 volts into the power used to drive the motors and hammers in the printer. Sensors are used to monitor the operation and status of critical components within the printer.

The printer uses five motors: two ribbon drive, one paper feed, one platen open, and one shuttle motor. The shuttle motor is a brushless DC motor driven by current control. The MPU encoder is used as feedback for motor commutations, hammer fire timing, and motor stall detection. The paper feed motor is a DC stepping motor driven by current control. The paper feed motor may be driven in full, half, or microsteps, depending on print requirements. The ribbon system uses two DC stepping motors that alternate drive and drag roles when the ribbon reaches turnaround. The drive ribbon motor is microstepped in voltage mode, while the drag motor is loaded and monitored to maintain correct linear speed and tension. The platen motor is driven in current mode and can be full or half stepped. The overall current level may be reduced for standby modes.

The paper feed, ribbon drive, and shuttle motors are driven in control loops containing power MOSFETs, voltage and current sensors, the MECA ASIC, and the EC processor. The platen open motor is driven by a stepping motor controller IC and the EC processor.

Control of the hammer drive is split between the controller board and the hammer bank. Common circuits are located on the controller board, while hammer specific circuitry is contained on the hammer bank. The EC uses the MECA ASIC on the controller board to set timing and upper drive profiles for hammer fire events. The controller also contains diagnostic circuitry for the hammer system. The hammer bank contains HBA ASICs that interpret fire commands and data from the MECA and VX ASICs. The HBAs control lower drive MOSFETs on the hammer bank. These determine which hammers will participate in a fire event generated by the controller’s upper drive.

Power Supply Board

The printer power supply is contained on a printed circuit board mounted in the card cage. The power supply automatically senses and adjusts to any commercial electrical system that provides AC mains potential in 50 or 60 Hertz systems. In other words, the printer is fully operational from available commercial power anywhere in the world.

The power supply converts alternating current (AC) to direct current (DC) at three voltage levels and sends the DC voltages to the controller board. The controller board distributes all DC power to the logic and electromechanical circuits.

AC Power

The power supply operates on AC voltages ranging from 88 to 270 V. It can tolerate variations in frequency of 47 to 63 Hz. The power supply is designed

to withstand an AC input overvoltage of 300 VAC for one second with no degradation of DC output voltage or damage to printer circuits.

DC Power

The power supply board contains two DC power supply systems for the printer. The first is a + 5 V bus for logic. The second consists of + 48 V and + 8.5 V buses for the hammer bank and all motors.

The + 5 V supply has an isolated return line that connects to the + 48 V return at the printer load. Both returns are tied together in a single-point ground. The + 5 V power supply has its own inverter, separate from the + 48 V and + 8.5 V outputs.

There is an opto-isolated input on the power supply that will shut down and latch off the + 48 V and + 8.5 V supplies unless it is pulled up to 5V with a 1K Ω resistor. This resistor is mounted on the controller board and may be pulled down or disconnected by software or internal cable interlocks. The + 5 V output will remain stable for reporting and latching the fault condition. The return for this signal is the + 5 V return. In addition, this shutdown circuit discharges and latches the + 48 V down to a level lower than 15 V in less than 200 milliseconds and requires recycling of the circuit breaker (On/Off switch) to reset the latch.

Loss of + 48 V is seen by the EC and reported as a fault.

Printer Interface

The printer interface is the point where the data line from the host computer plugs into the printer. The printer interface processes all signals and data to and from the host computer.

The printer supports supports a number of standard and optional interfaces to the host:

- Centronics parallel (standard)
- IEEE 1284 parallel (standard)
- EIA-232-E serial (standard)
- EIA-422-B serial (standard)
- Coaxial/twinaxial “Expansion-CT” (optional)
- Ethernet10Base-2 or 10Base-T adapter (optional)

Selection of the input/output interface is controlled by configuration menus accessed at the operator panel. It is possible to physically connect more than one interface, but only one interface at a time can be used electrically.

Graphics

The Code V programming language (a QMS graphics emulation) and the IGP programming language (a Printronix IGP emulation) are options that install in flash memory on the CMX controller board.

These programming languages simplify the job of creating forms, bar codes, logos, expanded characters, and other graphics. These languages enable the printer to print sideways, upside down, and to make forms combining graphics, alphanumeric data, and bar codes—all in a single pass. Documents explaining configuration, operation, and programming are included with each option.

5 Troubleshooting

Introduction

This chapter lists fault messages and symptoms, and provides procedures for troubleshooting printer malfunctions.

Always have the *Operator's Guide* and the *Setup Guide* handy when you troubleshoot because this manual does not cover printer operation or configuration. You must operate the printer to check its performance, and sometimes you may have to reconfigure it.

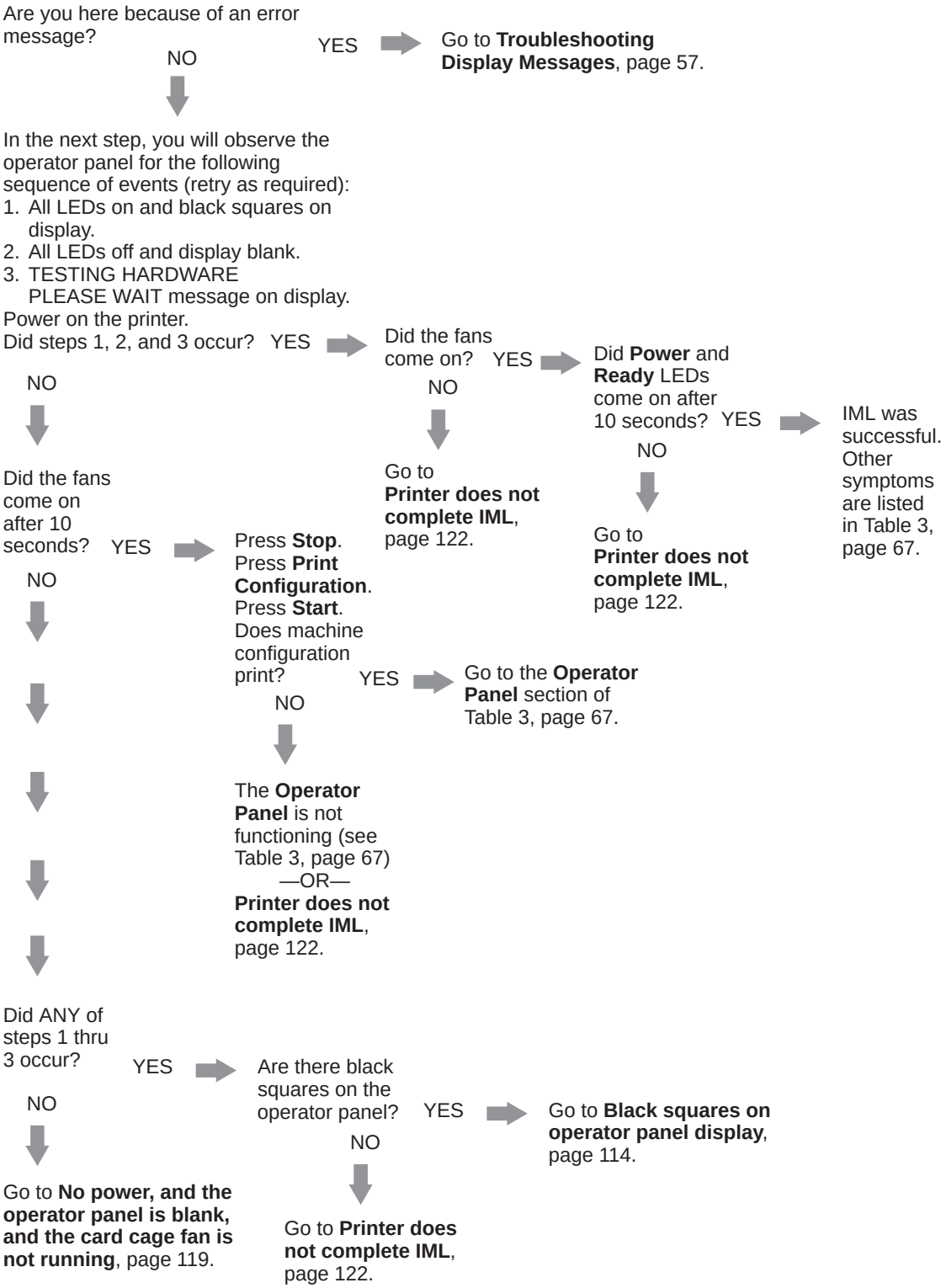
Troubleshooting Aids

Troubleshooting is faster and more effective if you understand the equipment and make use of all available tools.

This manual provides a number of troubleshooting aids to help you isolate printer malfunctions:

- **Start of Call** . . . . . Page 56
- **Troubleshooting Display Messages** . . . . . Page 57
- **Message List** . . . . . Page 58
- **Troubleshooting Other Symptoms** . . . . . Page 66
- **General Symptom List** . . . . . Page 67
- **Troubleshooting Procedures** . . . . . Page 70
- **Communications Failures** . . . . . Page 133
- **Operator Print Tests** . . . . . Page 135
- **Customer Engineer (CE) Tests** . . . . . Page 138
- **Hex Code Printout** . . . . . Page 145
- **ASCII Character Set** . . . . . Page 147
- **The Power On Sequence** . . . . . Page 151
- **Appendix A: Wire Data** . . . . . Page 293

Start of Call


Are you here because of an error message?
YES
Go to **Troubleshooting Display Messages**, page 57.
NO
In the next step, you will observe the operator panel for the following sequence of events (retry as required):
1. All LEDs on and black squares on display.
2. All LEDs off and display blank.
3. TESTING HARDWARE PLEASE WAIT message on display.
Power on the printer.
Did steps 1, 2, and 3 occur?
YES
Did the fans come on?
YES
Did **Power** and **Ready** LEDs come on after 10 seconds?
YES
IML was successful. Other symptoms are listed in Table 3, page 67.
NO
Go to **Printer does not complete IML**, page 122.
NO
Go to **Printer does not complete IML**, page 122.
Did the fans come on after 10 seconds?
YES
Press **Stop**. Press **Print Configuration**. Press **Start**. Does machine configuration print?
YES
Go to the **Operator Panel** section of Table 3, page 67.
NO
The **Operator Panel** is not functioning (see Table 3, page 67)
—OR—
Printer does not complete IML, page 122.
NO
Did ANY of steps 1 thru 3 occur?
YES
Are there black squares on the operator panel?
YES
Go to **Black squares on operator panel display**, page 114.
NO
Go to **Printer does not complete IML**, page 122.
NO
Go to **No power, and the operator panel is blank, and the card cage fan is not running**, page 119.

Troubleshooting Display Messages

DANGER:

<3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.

<4> Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.

<5> Power off the printer and disconnect the power cord before connecting or disconnecting communication port, teleport, or attachment cable connector.

If a fault condition occurs in the printer, four things happen:

- The **Attention** indicator on the operator panel flashes on and off.
- If enabled, the audible alarm sounds. (Press **Stop** to silence the alarm.)
- A message describing the fault condition appears on the LCD.
- Certain *Unit Check* conditions (see below) are automatically recorded in the error log. The error log is a buffer in NVRAM that stores up to 50 messages as a list. The most recent message is stored at the top of the list, the oldest message at the bottom of the list. If more than 50 messages occur before the log is cleared, the oldest messages are deleted, so the log never contains more than 50 messages. You can print the error log and clear it. (See page 135.)

The LCD displays two kinds of printer conditions:

- An *Attention* condition halts printing until the operator replenishes supplies, clears paper jams, corrects a problem of communication between the printer and host computer, etc.
- A *Unit Check* condition is a failure detected by self-test and fault circuitry. Unit check conditions are either *recoverable* or *unrecoverable*.

a. *Recoverable* unit check conditions are errors detected in the electromechanical print mechanism that may be temporary and correctable by cycling power. The printer tries a number of times to correct the condition before posting the message to the operator panel. The first thing to do in such cases is to power the printer off, wait 15 seconds, then power the printer back on. If the message reappears, classify the check condition unrecoverable.

b. *Unrecoverable* unit check conditions are “hard” failures such as overcurrent, component failure, or microcode failures that prevent printing until the conditions are corrected. Unrecoverable conditions require that the printer be powered off and the condition corrected before powering the printer back on.

Clearing Error Messages

Refer to the **Message List** below, which lists the display messages numerically and alphabetically and directs you to a troubleshooting procedure.

After correcting an error, press the **Stop** key to clear the message and return the printer to the NOT READY state. Press **Start** to resume printing.

(If an error is not cleared, the printer will try to print again but will display another error message until the error is cleared.)

Table 2. Message List

Operator Panel Message	Troubleshooting Procedure
001 END OF FORMS LOAD FORMS	Page 70
002 FORMS JAMMED CLEAR JAM AND RELOAD FORMS	Page 70
003 FORMS EJECTED PRESS EJECT/RESTORE	Page 72
004 VIEW FORMS PRESS VIEW KEY	Page 72
006 HOST SYSTEM REQUEST ATTENTION	Page 72
007 FM HEADER ERROR	Page 72

Operator Panel Message	Troubleshooting Procedure
008 HOLD PRINT TIMEOUT PRESS START	Page 72
009 INVALID KEY PRESS	Page 72
010 PARAMETER ERROR	Page 73
011 SCS COMMAND ERROR	Page 73
012 STRUCTURED FIELD ERROR	Page 73
013 ACTIVATE LOST	Page 74
014 INVALID ACTIVATE	Page 74
015 COMMUNICATION CHECK CHECK CABLE	Page 75
016 INVALID COMMAND	Page 75
017 STACKER JAM CHECK STACKER	Page 76
018 STACKER FULL CHECK STACKER	Page 76
019 STACKER FAULT CHECK STACKER	Page 77
021 RECEIVE BUFFER OVERRUN VERIFY CONFIGURATION	Page 78
022 UNIT ADDRESS NOT RECEIVED CHECK PRINTER ADDRESS	Page 78
024 SERIAL LINE PARITY ERROR VERIFY CONFIGURATION	Page 78
025 SERIAL FRAMING ERROR VERIFY CONFIGURATION	Page 78
026 HEX DUMP MODE	Page 79
027 COMMUNICATIONS CHECK CALL SYSTEM OPERATOR	Page 79
028 COMMUNICATIONS CHECK CALL SYSTEM OPERATOR	Page 79
029 8344 DIAGNOSTIC TEST FAILED	Page 79

Operator Panel Message	Troubleshooting Procedure
031 END OF FORMS TIMEOUT LOAD FORMS	Page 79
032 FORMS JAMMED TIMEOUT CLEAR JAM AND RELOAD FORMS	Page 80
041 BUFFER OVERFLOW	Page 81
042 CUSTOM SET DOES NOT EXIST SAVE FIRST	Page 82
043 CUSTOM SET ALREADY EXISTS DELETE EXISTING SET FIRST	Page 82
044 EC FIRMWARE/HARDWARE ERROR	Page 82
046 EC STOPPED AT STATE <state>	Page 82
057 CLOSE PLATEN	Page 83
058 SHUTTLE JAM SEE USER'S GUIDE	Page 84
059 CANCEL PRINT ACTIVE	Page 85
060 PRINTER HOT	Page 85
062 EXHAUST FAN FAULT	Page 86
065 HAMMER BANK FAN FAULT	Page 86
069 DATA CLEARED	Page 87
080 POWER SUPPLY HOT	Page 87
081 POWER SUPPLY VOLTAGE FAILURE	Page 88
082 POWER SUPPLY 8.5V FAILED	Page 88
083 INTAKE FAN FAULT	Page 89
084 POWER SUPPLY 48V FAILED	Page 89
085 CONTROLLER VOLTAGE	Page 90
086 CONTROLLER 15V	Page 90
087 PLATEN OPEN TIMEOUT CLOSE PLATEN	Page 91
088 CONTROLLER 23.5V	Page 92

Operator Panel Message	Troubleshooting Procedure
089 RIBBON STALL	Page 92
090 SHUTTLE COVER OPEN CLOSE SHUTTLE COVER	Page 93
092 RIBBON DRIVER CIRCUIT	Page 93
101 UPPER DRIVER SHORT	Page 94
102 LOWER DRIVER SHORT	Page 94
105 HAMMER COIL <number> OPEN	Page 94
107 HAMMER COIL <number> HOT	Page 95
110 STACK OVERFLOW SEE USER'S GUIDE	Page 96
111 STACK UNDERFLOW SEE USER'S GUIDE	Page 96
112 UNDEFINED OPCODE SEE USER'S GUIDE	Page 96
113 PROTECTED INSTRUCTION SEE USER'S GUIDE	Page 96
114 ILLEGAL OPERAND ACCESS SEE USER'S GUIDE	Page 97
115 ILLEGAL INSTRUCTION ACCESS SEE USER'S GUIDE	Page 97
116 ILLEGAL EXTERNAL BUS ACCESS SEE USER'S GUIDE	Page 97
117 A TO D OVERRUN SEE USER'S GUIDE	Page 97
118 UNDEFINED INTERRUPT SEE USER'S GUIDE	Page 98
119 TCB CORRUPTED SEE USER'S GUIDE	Page 98
120 ACCESS NULL POINTER SEE USER'S GUIDE	Page 98
121 PAPER NOT AT SPEED SEE USER'S GUIDE	Page 98

Operator Panel Message	Troubleshooting Procedure
122 PAPER NOT SCHEDULED SEE USER'S GUIDE	Page 99
123 PAPER BUSY TOO LONG SEE USER'S GUIDE	Page 99
124 PAPER FIFO OVERFLOW SEE USER'S GUIDE	Page 100
125 PAPER FIFO UNDERFLOW SEE USER'S GUIDE	Page 100
126 PAPER FEED BAD TABLE SEE USER'S GUIDE	Page 101
127 PAPER FEED ILLEGAL STATE SEE USER'S GUIDE	Page 101
128 PAPER FEED INVALID COMMAND SEE USER'S GUIDE	Page 101
129 PAPER FEED INVALID PARAMETER SEE USER'S GUIDE	Page 102
130 PAPER FEED PARTLY ENERGIZED SEE USER'S GUIDE	Page 102
131 PAPER FEED INTERRUPT SEE USER'S GUIDE	Page 102
132 RIBBON INVALID COMMAND SEE USER'S GUIDE	Page 102
133 RIBBON INVALID STATE SEE USER'S GUIDE	Page 103
134 PLATEN INVALID COMMAND SEE USER'S GUIDE	Page 103
135 PLATEN INVALID STATE SEE USER'S GUIDE	Page 103
136 PLATEN INVALID PARAMETER SEE USER'S GUIDE	Page 103
137 SHUTTLE INVALID COMMAND SEE USER'S GUIDE	Page 104

Operator Panel Message	Troubleshooting Procedure
138 SHUTTLE INVALID PARAMETER SEE USER'S GUIDE	Page 104
139 SHUTTLE OVERSPEED SEE USER'S GUIDE	Page 104
990 MACHINE CHECK	Page 105
998 NON-VOLATILE MEMORY FAILED	Page 105
A97 GRAPHIC CHECK ERROR PRESS STOP THEN START	Page 105
BOOT DIAGNOSTICS	Page 105
CLEARING PROGRAM FROM FLASH	Page 105
DRIVER CIRCUIT BAD	Page 105
ENERGY SAVER MODE ACTIVE	Page 105
ERROR: DRAM NOT DETECTED	Page 106
ERROR: DRAM AT ADDRESS <hex>	Page 106
ERROR: FLASH DID NOT PROGRAM	Page 106
ERROR: PROGRAM NOT VALID	Page 106
ERROR: SECURITY PAL NOT DETECTED	Page 106
ERROR: SHORT AT ADDRESS XXXX	Page 107
FM HEADER ERROR	Page 107
HAMMER BANK NOT INSTALLED	Page 107
HAMMER COIL BAD #, #, #, #, ... etc.	Page 108
LOADING PROGRAM FROM PORT XX%	Page 108
LOADING PROGRAM INTO FLASH	Page 108
NOT READY	Page 108
OPERATOR MENU <first menu item>	Page 108
OPERATOR MENU LOCKED	Page 108

Operator Panel Message	Troubleshooting Procedure
OPERATOR MENU UNLOCKED	Page 108
PA1 SELECTED	Page 109
PA2 SELECTED	Page 109
P05 DIAGNOSTIC TEST PASSED	Page 109
P17 SECURITY VIOLATION	Page 109
P60 ERROR: DRAM AT ADDRESS <hex>	Page 109
P61 ERROR: FLASH NOT DETECTED	Page 110
P62 ERROR: DC PROGRAM NOT VALID	Page 110
P63 ERROR: PROGRAM NOT COMPATIBLE	Page 110
P64 ERROR: CHECKSUM WRONG <hex>	Page 110
P65 ERROR: PROGRAM NEEDS MORE FLASH	Page 111
P66 ERROR: PROGRAM NEEDS MORE DRAM	Page 111
P67 ERROR: WRITING TO FLASH	Page 111
P68 ERROR: EC PROGRAM NOT VALID	Page 111
P69 ERROR: EC STOPPED AT STATE XXXX	Page 111
PLEASE WAIT... RESET IN PROGRESS	Page 112
READY	Page 112
RESETTING... PLEASE WAIT	Page 112
RESTORING BOOT CODE	Page 112

Operator Panel Message	Troubleshooting Procedure
RIBBON OUT OF INK CHANGE RIBBON	Page 112
SENDING PROGRAM TO EC PROCESSOR	Page 113
SERVICE <first service test>	Page 113
SOFTWARE ERROR* Cycle power	Page 113
TABLE MISMATCH DOWNLOAD AGAIN	Page 113
TESTING HARDWARE PLEASE WAIT	Page 113
TOP OF FORM SET	Page 113
WAITING FOR PROGRAM DOWNLOAD	Page 114

Troubleshooting Other Symptoms

DANGER:

<3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.

<4> Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.

<5> Power off the printer and disconnect the power cord before connecting or disconnecting communication port, teleport, or attachment cable connector.

Use standard fault isolation techniques to troubleshoot malfunctions that are not indicated by display messages. These techniques are summarized below:

1. Ask the operator to describe the problem.
2. Verify the fault by running a diagnostic printer test or by replicating conditions reported by the user.
3. Look for a match in the **General Symptom List** that begins on page 67. If you find a match, go to the troubleshooting procedure and follow the numbered instructions.
4. If you do not find the symptom in the General Symptom List, use the Half-Split Method to find the malfunction:
   a. Start at a general level and work down to details.
   b. Isolate faults to half the remaining system at a time, until the final half is a field-replaceable part or assembly. (Troubleshooting aids are listed on page 55.)

IMPORTANT

Do not attempt field repairs of electronic components or assemblies. Replace a malfunctioning electronic assembly with an operational spare. Most electronic problems are corrected by replacing the printed circuit board assembly, sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank: replace the entire shuttle frame assembly. It is not field repairable.

5. Replace the defective part or assembly.
6. Test printer operation after every corrective action.
7. Reinstall any parts you replaced earlier that did not solve the problem.
8. Stop troubleshooting and return the printer to normal operation when the reported symptoms disappear.

Table 3. General Symptom List

Symptom	Troubleshooting Procedure
Communications Failures	Page 133
Jams	
CLEAR JAM message instead of LOAD FORMS when printer is out of paper	Page 115
CLEAR JAM message will not clear and paper does not move	Page 116
CLEAR JAM message will not clear but paper moves	Page 116
Operator Panel	
Black squares on operator panel display	Page 114
Operator panel blank	Page 120
Operator panel display shows garbled, broken characters	Page 120
Operator panel keys do not work	Page 121
Power / IML Failures	
No power, and the operator panel is blank, and the card cage fan is not running	Page 119

Symptom	Troubleshooting Procedure
Printer does not complete IML	Page 122
Power Stacker	
Printer does not detect presence of power stacker	Page 123
Stacker chatters at upper or lower limit	Page 128
Stacker does not stack properly	Page 128
Stacker elevator does not move	Page 128
Stacker elevator moves by itself	Page 129
Stacker limit switch check	Page 129
Stacker motor check	Page 130
Stacker not operating	Page 123
Print Quality	
Characters or dots are missing, smeared, too light, or too dark	Page 114
Horizontal misalignment of characters (Dots or characters move left or right from dot row to dot row or line to line)	Page 118
Randomly misplaced dots	Page 125
Vertical misalignment of characters: 1. Dots or characters move up or down from dot row to dot row or line to line 2. Incorrect spacing from dot row to dot row or line to line 3. Characters randomly compressed and/or enlarged	Page 132
Printer Operation	
Downloads consistently fail	Page 117
Flash SIMM won’t copy	Page 118
Paper feeds poorly	Page 121
Printer does not print self tests	Page 124

Symptom	Troubleshooting Procedure
Reverse paper feed: platen does not open	Page 124
TOF is lost repeatedly	Page 131
Ribbon	
Ribbon folding or feed problems	Page 125
Shuttle	
Shuttle does not move	Page 126
Shuttle is noisy	Page 127

Troubleshooting Procedures

MESSAGE / MALFUNCTION
TEST / INSPECTION / EXPLANATION
CORRECTIVE ACTION

001 END OF FORMS
LOAD FORMS

1. Attention message: the printer is out of paper.

   Load paper. Press **Stop**. If message does not clear, go to step 2.

2. Check forms for dark backs or holes/perforations large enough to cause false End Of Forms messages.

   Consider ordering the black back paper detector switch assembly.

3. Power off the printer. Remove the paper guide assembly or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model, see Figure 44, page 271). Check that the paper detector switch assembly is securely mounted in its bracket and the sensors are clean.

   Make sure the sensors are securely snapped into the bracket, the mounting screws hold the paper detector switch assembly securely, and clean the sensors if they are dirty.

4. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.

   Connect P106/PMD to J106 on the CMX controller board.

5. Power on the printer. Load paper.

   Replace the paper detector switch assembly if the message appears.

6. Power on the printer. Load paper.

   Replace the CMX controller board if the message appears. Record the message and return it with the defective board.

002 FORMS JAMMED
CLEAR JAM AND RELOAD FORMS

1. Attention message: the printer cannot detect paper motion. Inspect the paper path for jams.

   Clear jams. Load paper.

2. Press **Form Feed** several times and check that forms feed without erratic motion, noise, or pin-hole damage.

   If forms do not feed, go to **Paper feeds poorly**, page 121.
   If forms feed, go to step 3.

3. Press **View** once and check that forms move up.

   Make sure the forms thickness lever is not set too tightly.

4. Press **View** again and check that the forms thickness lever rotates and the paper moves down.

   If the forms thickness lever does not rotate and/or the paper does not move down, refer to **Reverse paper feed: platen does not open**, page 124.

5. Check the paper tension between the tractors.

   Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension.

6. Inspect the ribbon mask for bends or deformation that block the paper path or prevent paper from exiting the pedestal top cover.

   Replace a damaged hammer bank cover assembly.

7. Check the condition and tension of the platen open belt.

   Adjust the platen open belt. Replace the belt if it is damaged.

8. Check the platen open pulley and the platen pulley for looseness.

   Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 9 ± 2 inch-pounds (1.02 ± 0.23 N•m). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.

9. Inspect the tractors and tractor door springs for damage or excessive wear.

   If either tractor is worn or damaged, replace both tractor assemblies.

10. Check the condition and tension of the paper feed belt.

    Adjust the paper feed belt. Replace the belt if it is damaged.

11. Check the platen gap.

    Adjust the platen gap.

12. Clean the paper motion detector with a cotton swab and alcohol. At the control panel, set the paper motion detector (PMD) fault setting to DISABLE. Load paper. Run a print test and observe how the paper feeds.

    If the message appears, replace the CMX controller board. Record the message and return it with the defective board. If the message does not appear, replace the paper detector switch assembly and set the paper motion detector (PMD) to ENABLE.

003 FORMS EJECTED
PRESS EJECT / RESTORE

1. Non-error status message.

    Press **Eject/Restore** key to return paper to print position.

004 VIEW FORMS
PRESS VIEW KEY

1. Non-error status message.

    Press **View** key to return paper to print position.

006 HOST SYSTEM REQUEST ATTENTION

2. Host attention message: the host computer or printer controller requires attention.

    Not a printer problem.

007 FM HEADER ERROR

3. Applications software has violated header format parameters.

    Not a printer problem. Have the system administrator correct applications data or configuration.

008 HOLD PRINT TIMEOUT
PRESS START

1. Status message: the printer was offline more than 10 minutes and the "Intervention Required" parameter is set to "Send to Host."

    Press **Start** to put the printer in the READY state.

009 INVALID KEY PRESS

1. Attention message informing the operator that the wrong key was pressed.

    No action required.

010 PARAMETER ERROR

1. The printer received an illegal parameter value in the command code.

   Press **Stop** to clear fault. Press **Start** to go on-line.

2. Run the print job that generated the error message.

   If the message appears, check the host data for invalid characters.

3. Ask the system operator to verify that the printer's Device ID is set to the correct emulation with respect to the host configuration.

   Set printer Device ID to the correct emulation with respect to the host configuration.

4. Run the print job that generated the error message.

   If the message appears, go to **Communications Failures**, page 133.

011 SCS COMMAND ERROR

1. The printer received an undefined control character (hex 40) through the coax/twinax interface.

   The printer clears the error.

2. Run the print job that generated the error message.

   If the message appears, verify that there are no invalid control codes in the host data.

3. Ask the system operator to verify that the printer's Device ID is set to the correct emulation with respect to the host configuration.

   Set the printer Device ID to the correct emulation with respect to the host configuration.

4. Run the print job that generated the error message.

   If the message appears, go to **Communications Failures**, page 133.

012 STRUCTURED FIELD ERROR

1. Application software has violated structured data field parameters.

   Not a printer problem. Have the system administrator correct applications data or configuration.

013 ACTIVATE LOST

1. The printer detects a twinax protocol communication error and reports the error. Power off the printer. Disconnect the AC power cord from the printer. Check the twinax host data cable and twinax I/O cable connection at the CT board.

   Reseat the twinax host data cable connection and the twinax I/O cable connection at the CT board.

2. Disconnect the twinax auto-termination cable from the printer. Test the cable for the resistances shown on page 321.

   If resistances are not correct, replace the twinax auto-termination cable.

3. Connect the power cord to the printer. Power on the printer. Send a print job to the printer.

   If the message appears, replace the twinax cable.

4. Send a print job to the printer.

   If the message appears, go to **Communications Failures**, page 133.

014 INVALID ACTIVATE

1. The printer detects a twinax protocol communications error and reports the error. Power off the printer. Disconnect the AC power cord from the printer. Check the twinax host data cable and twinax I/O cable connection at the CT board.

   Reseat the twinax host data cable connection and the twinax I/O cable connection at the CT board.

2. Disconnect the twinax auto-termination cable from the printer or from the last device on this twinax port. Test the cable for the resistances shown on page 321.

   If resistances are not correct, replace the twinax auto-termination cable.

3. Connect the power cord to the printer. Power on the printer. Send a print job to the printer.

   If the message appears, replace the twinax cable.

4. Send a print job to the printer.

   If the message appears, go to **Communications Failures**, page 133.

015 COMMUNICATION CHECK
CHECK CABLE

1. The line is not active on a twinax interface. Power off the printer. Disconnect the AC power cord from the printer. Check the twinax host data cable connection and twinax I/O cable connection at the CT board.

   Reseat the twinax host data cable connection and the twinax I/O cable connection at the CT board.

2. Disconnect the twinax auto-termination cable from the printer. Test the cable for the resistances shown on page 321.

   If resistances are not correct, replace the twinax auto-termination cable.

3. Connect the AC power cable to the printer. Power on the printer. Send a print job to the printer. Verify that all other devices on the twinax line are working properly. (Refer to line problem determination procedures, as recommended by the host system.)

   If the message is gone, the host has reestablished communication with the printer. If all other twinax devices work properly and the message still appears, replace the coax/twinax expansion board. Record the message and return it with defective board.

016 INVALID COMMAND

1. The printer detects a twinax protocol communications error and reports the error. Power off the printer. Disconnect the AC power cord from the printer. Check the twinax host data cable and twinax I/O cable connection at the CT board.

   Reseat the twinax host data cable connection and the twinax I/O cable connection at the CT board.

2. Disconnect the twinax auto-termination cable from the printer. Test the cable for the resistances shown on page 321.

   If resistances are not correct, replace the twinax auto-termination cable.

3. Connect the power cord to the printer. Power on the printer. Send a print job to the printer.

   If the message appears, replace the twinax cable.

4. Send a print job to the printer.

   If the message appears, go to **Communications Failures**, page 133.

017 STACKER JAM

CHECK STACKER Message

1. Paper is bunching above the elevator or the paper motion detector is not working properly.

   Remove the paper jam.

2. Power off the printer. Check that the wheel of the stacker paper motion detector rests against the rear brace of the paper throat. Also make sure the wheel rotates freely on its axle.

   If necessary, gently bend the brace toward the paper motion detector wheel until the wheel contacts the brace. Clean the stacker paper motion detector.

3. Power on the printer. Operate the power stacker. (Refer to the *Operator's Guide*.) While the stacker is operating, check that:
   a) all motors are operating
   b) the paddles are rotating
   c) the elevator moves smoothly and without obstruction
   d) the timing belts are undamaged and the belt pulleys are not slipping
   e) the extension springs are attached and undamaged (not bent or stretched)
   f) the drive rollers are not damaged

   Tighten pulley setscrews and/or replace damaged components as necessary.

4. Power off the printer. Remove the paper guide assembly. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Figure 61, page 380). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)

   Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

018 STACKER FULL

CHECK STACKER Message

1. Status message: the power paper stacker is full.

   Unload the stacker.

2. Check the stacker limit switches. (See page 129.)

   If the limit switches are OK, go to the next step.

3. Power off the printer. Remove the paper guide assembly. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control

panel (see Figure 61, page 380). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)

Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

019 STACKER FAULT

CHECK STACKER Message

NOTE: This message is triggered when the elevator cannot reach either the top or bottom position switch before timing out.

1. Power on the printer. Operate the power stacker. (Refer to the *Operator's Guide*.) Check for obstructions preventing elevator movement.

   Remove obstructions.

2. Operate the power stacker. While the stacker is operating, check that:
   a) all motors are operating
   b) the paddles are rotating
   c) the elevator moves smoothly and without obstruction
   d) the timing belts are undamaged and the belt pulleys are not slipping
   e) the extension springs are attached and undamaged (not bent or stretched)
   f) the drive rollers are not damaged
   g) the constant force springs are tightly mounted and undamaged

   Tighten pulley setscrews and/or replace damaged components as necessary.

3. Check for misaligned stacker rails

   Adjust the stacker rails if they are not vertical and parallel.

4. Check the stacker limit switches. (See page 129.)

   If the limit switches are OK, go to the next step.

5. Disable the power stacker unit under the Printer Control menu. (Refer to the *Setup Guide*.)

   If the message occurs, replace the CMX controller board.

6. Power off the printer. Remove the paper guide assembly. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Figure 61, page 380). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)

Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

021 RECEIVE BUFFER OVERRUN

VERIFY CONFIGURATION

1. The print buffer has overflowed on a serial interface. The printed output may contain random * (asterisk) characters. Make a configuration printout. Verify that the printer matches the host serial interface configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.

   Set printer serial interface parameters to match those of the host.

2. Send a print job to the printer.

   If the message appears, go to **Communications Failures**, page 133.

022 UNIT ADDRESS NOT RECEIVED

CHECK PRINTER ADDRESS

1. Poll timeout on the twinax interface indicating the unit address is not recognized by the printer.

   Have the system administrator make sure the printer address is correct.

024 SERIAL LINE PARITY ERROR

VERIFY CONFIGURATION

1. The printed output may contain random ? (question mark) characters. Make a configuration printout. Verify that the printer matches host serial configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.

   Set printer serial interface parameters to match those of the host.

2. Send a print job to the printer.

   If the message appears, replace the serial data cable.

3. Send a print job to the printer.

   If the message appears, go to **Communications Failures**, page 133.

025 SERIAL FRAMING ERROR

VERIFY CONFIGURATION

1. The printed output may contain random ! (exclamation point) characters. Make a configuration printout. Verify that the printer matches host configuration settings

for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.

Set printer serial interface parameters to match those of the host.

2. Send a print job to the printer.

   If the message appears, go to **Communications Failures**, page 133.

026 HEX DUMP MODE

1. Printer attach status message.

   No action required.

027 COMMUNICATIONS CHECK
CALL SYSTEM OPERATOR

1. Enable poll timeout. The printer was not enabled for one minute over a coax interface. Power off the printer. Disconnect the AC power cord from the printer.

   Check data cable connection and host system. (Refer to line problem determination procedures, as recommended by the host system.)

028 COMMUNICATIONS CHECK
CALL SYSTEM OPERATOR

1. Poll timeout error. The printer was not polled for one minute over a coax interface. Power off the printer. Disconnect the AC power cord from the printer.

   Check data cable connection and host system. (Refer to line problem determination procedures, as recommended by the host system.)

029 8344 DIAGNOSTIC TEST FAILED

1. Link-level code test detects a hardware failure on the coax/twinax expansion board. This message can also occur if the software in flash memory is corrupted.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the coax/twinax expansion board. Record the message and return it with defective board.

031 END OF FORMS TIMEOUT
LOAD FORMS

1. On a coax interface, a timeout message is sent to the host if paper is not loaded within 10 minutes after **Stop** was pressed to clear an end of forms fault.

Load paper. Press **Stop**. If message does not clear, go to step 3.

2. Power off the printer. Remove the paper guide assembly or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket.

   Install the paper detector switch assembly.

3. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.

   Connect P106/PMD to J106 on the CMX controller board.

4. Power on the printer. Load paper.

   Replace the paper detector switch assembly if the message appears.

5. Power on the printer. Load paper.

   Replace the CMX controller board if the message appears. Record the message and return it with the defective board.

032 FORMS JAMMED TIMEOUT
CLEAR JAM AND RELOAD FORMS

1. On a coax interface, a timeout message is sent to the host if paper motion has not occurred for 10 minutes after **Stop** was pressed to clear a paper jam fault.

   Clear the paper jam. Press **Stop**.

2. Press **Form Feed** several times and check that forms feed without erratic motion, noise, or pin-hole damage.

   If forms do not feed, go to **Paper feeds poorly**, page 121.
   If forms feed, go to step 3.

3. Press **View** once and check that forms move up.

   Make sure the forms thickness lever is not set too tightly.

4. Press **View** again and check that the forms thickness lever rotates and the paper moves down.

   If the forms thickness lever does not rotate and/or the paper does not move down, refer to **Reverse paper feed: platen does not open**, page 124.

5. Check the paper tension between the tractors.

   Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension.

6. Inspect the ribbon mask for bends or deformation that block the paper path or prevent paper from exiting the pedestal top cover.

   Replace a damaged hammer bank cover assembly.

7. Check the condition and tension of the platen open belt.

   Adjust the platen open belt. Replace the belt if it is damaged.

8. Check the platen open pulley and the platen pulley for looseness.

   Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 9 ± 2 inch-pounds (1.02 ± 0.23 N•m). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.

9. Inspect the tractors and tractor door springs for damage or excessive wear.

   If either tractor is worn or damaged, replace both tractor assemblies.

10. Check the condition and tension of the paper feed belt.

    Adjust the paper feed belt. Replace the belt if it is damaged.

11. Check the platen gap.

    Adjust the platen gap.

12. Clean the paper motion detector with a cotton swab and alcohol. At the control panel, set the paper motion detector (PMD) fault setting to DISABLE. Load paper. Run a print test and observe how the paper feeds.

    If the message appears, replace the CMX controller board. Record the message and return it with the defective board. If the message does not appear, replace the paper detector switch assembly and set the paper motion detector (PMD) to ENABLE.

041 BUFFER OVERFLOW

1. The print buffer has overflowed on a serial interface. The printed output may contain random * (asterisk) characters. Make a configuration printout. Verify that the printer matches the host serial interface configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.

   Set printer serial interface parameters to match those of the host.

2. Send a print job to the printer.

   If the message appears, go to **Communications Failures**, page 133.

042 CUSTOM SET DOES NOT EXIST
SAVE FIRST

1. Printer configuration: the custom configuration set does not exist.

   Save the custom configuration set.

043 CUSTOM SET ALREADY EXISTS
DELETE EXISTING SET FIRST

1. Printer configuration: custom set is write-protected.

   Delete the existing custom configuration set, then save the new set.

044 EC FIRMWARE/HARDWARE ERROR

1. Application software tried to perform an illegal printer function or damaged memory is detected on the CMX controller board. (If the message appears at power-up, replace the CMX controller board. Record the message and return it with defective CMX board.)

   Cycle power. Run the print job. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the flash memory.

3. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

4. Power on the printer. Run the print job again.

   If the message still appears, there is an application software error. Use your local support procedure to request assistance.

046 EC STOPPED AT STATE <state>

NOTE: If the EC stops at state 0000 at power-up, replace the CMX controller board. Record the message and return it with the defective board.

1. Where <state> is a number from 0000 to 0010. The Engine Controller processor has stopped and is in the state identified by the number displayed. Power off the printer. Remove all flash memory and DRAM SIMMs. Inspect the SIMM sockets on the CMX controller board.

If any socket pins are bent or damaged, replace the CMX controller board.

2. Install the flash and DRAM SIMMs, making sure they are fully and correctly seated. Power on the printer. Download the emulation.

   If the message appears, replace the flash SIMM(s).

3. Power on the printer. Download the emulation.

   If the message appears, replace the DRAM SIMM(s).

4. Power on the printer. Download the emulation.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

057 CLOSE PLATEN

1. The forms thickness lever is open.

   Load paper. Close the forms thickness lever.

2. Power off the printer. Remove the paper guide assembly or pedestal top cover. Disconnect connector P107 from the CMX controller board. Check continuity of the platen interlock switch cable from P107/PLO to the switch.

   Replace the platen interlock switch assembly if it fails the continuity test. (Refer to Appendix A, Switch Assembly, Platen Interlock.)

3. Check that the platen interlock switch is not loose.

   Tighten the screws securing the platen interlock switch

4. Check the condition and tension of the platen open belt.

   Adjust the platen open belt. Replace the belt if it is damaged.

5. Check the platen open pulley and the platen pulley for looseness.

   Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 9 ± 2 inch-pounds (1.02 ± 0.23 N•m). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.

6. Disconnect connector P106 from the CMX controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables on page 297.)

   Replace the platen open motor if it fails the resistance test.

7. Run a print test.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

058 SHUTTLE JAM
SEE USER'S GUIDE

1. The shuttle is not moving or is moving at the wrong speed. Check the forms thickness lever: if it is set too tightly, it can slow the shuttle enough to trigger the fault message.

   Set the forms thickness lever to match the thickness of paper and provide satisfactory print quality, but not too tightly.

2. Check the platen gap.

   Adjust the platen gap.

3. Inspect the ribbon mask for bends or deformation that snag and interfere with shuttle movement. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs.

   Reinstall the hammer bank cover assembly. Replace a damaged or deformed hammer bank cover assembly.

4. Run a print test.

   If the message appears, power off the printer.

5. Remove the shuttle cover. Remove the paper guide assembly or the pedestal top cover. Inspect the shuttle mechanism for obstructions. Check that all cables are attached at the shuttle and the CMX controller board. Make sure the MPU cable is not pinched. (Refer to Appendix A, Interconnection Diagram, page 295.)

   Remove obstructions and reseat all cables. Check the resistance of MPU in P107. (Refer to the Main Wire Test Tables, page 297.) Replace the MPU if it fails the test.

6. Run a shuttle test and observe shuttle movement.

   If the shuttle oscillates too slowly, adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m).

7. Run a print test.

   If the message appears, replace the MPU and the MPU cable assembly.

8. Run a print test.

If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

9. Run a print test.

   If the message appears, replace the power supply board.

10. Run a print test.

    If the message appears, replace the shuttle frame assembly.

059 CANCEL PRINT ACTIVE

1. Non-error status message.

   No action required.

060 PRINTER HOT

NOTE: This message indicates internal temperatures over 60° Celsius (140° Fahrenheit). Print jobs will not create such temperatures, so immediately determine that the fans are operating and that all air vents are unobstructed. It is crucial that the exhaust vents on the floor of the cabinet remain unblocked, since hot air from inside the printer is vented through the cabinet floor. Nothing must be stored under the printer. Then check the operating environment. A severe environment is one with an ambient temperature at or above above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area or reduce the size and duration of the print jobs.

1. CMX controller board sensors report high temperatures on the board. Inspect printer environment for severity. (See NOTE above.)

   Advise the user to move the printer to cooler, cleaner location.

2. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check that all fan cables are connected.

   Connect all fan cables.

3. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents.

   Remove any obstructions from vents and airways.

4. Install the paper guide assembly or pedestal top cover. Power on the printer. Load paper. Run the Plot Test for 1/4 page.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

062 EXHAUST FAN FAULT

1. Sensors cannot detect current in the fan circuit.

   Cycle power. If the message appears, press **Stop**.

2. If the message occurs on a pedestal model, check that the correct operator panel is installed. The operator panel for a pedestal model has resistors R18 and R19 next to the operator panel cable connector.

   Install the correct operator panel for a pedestal model:

3. Check that the exhaust fan is connected to exhaust fan cable connector J307.

   Connect the fan cable connector.

4. Power off the printer. Remove the paper guide assembly. Disconnect connector P107 from the CMX controller board. Test connector P107/EHF for shorts or opens. (Refer to the Main Wire Harness Test Tables on page 297.)

   Replace components that fail test.

5. Make sure connector P107/EHF has a good connection at J107 on the CMX controller board.

   Connect P107 to the CMX controller board.

6. Inspect for obstructions of airways and vents. Check for items beneath the printer blocking cabinet vents.

   Remove obstructions. Make sure cabinet exhaust fan vents are not blocked.

7. Power on the printer. Check for fan operation.

   If the message appears or the fan doesn't work, replace the exhaust fan.

8. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

065 HAMMER BANK FAN FAULT

1. Hammer Bank Fan Fault. Sensors cannot detect current in the fan circuit.

Cycle power. If the message appears, press **Stop**.

2. Power off the printer. Remove the paper guide assembly or pedestal top cover. Disconnect connector P107 from the CMX controller board. Test connector P107/HBF for shorts or opens. (Refer to the Main Wire Harness Test Tables on page 297.)

   Replace components that fail test.

3. Make sure P107/HBF has a good connection at J107 on the CMX controller board.

   Connect P107 to the CMX controller board.

4. Inspect for obstructions of airways and vents.

   Remove obstructions.

5. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

069 DATA CLEARED

1. This message appears when data are cleared out of printer after **Cancel** key has been pressed.

   No action required.

080 POWER SUPPLY HOT

NOTE: The printer has sensor circuits that sample the operating temperature of key components of the power supply. When higher than normal temperatures are sensed, print speed is automatically reduced. If the printer runs at reduced speed for an extended period of time, the POWER SUPPLY HOT message is sent to the LCD and printing stops, allowing printer components to cool down. Pressing the **Start** key resumes the print task. Check the operating environment. A severe environment is one with an ambient temperature at or above above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area or reduce the size and duration of the print jobs.

1. Inspect printer environment for severity. (See NOTE above.)

Advise the user to move the printer to cooler, cleaner location.

2. Check the kinds of print jobs the user is running: look for very dense graphics and layouts.

   Advise the user to run jobs in smaller batches.

3. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check that the power supply guard/air deflector is correctly positioned over the power supply board. **CAUTION: DO NOT TOUCH THE POWER SUPPLY**, but hold your hand close enough to check for heat radiating off the power supply board.

   If the power supply is noticeably hot, replace it.

4. Check that all fan cables are connected.

   Connect all fan cables.

5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents.

   Remove any obstructions from vents and airways.

6. Install paper guide assembly or pedestal top cover. Power on the printer. Load paper. Run the “All E’s” print test for 5–10 minutes.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

081 POWER SUPPLY VOLTAGE FAILURE

1. The power supply has failed.

   Replace the power supply board.

2. Power on the printer.

   If the message appears, replace the CMX controller board.

082 POWER SUPPLY 8.5V FAILED

1. 8.5 Volt Power Failed. Internal power failure.

   Cycle power. If the message appears, replace the power supply board.

2. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

3. Power on the printer.

If the message appears, replace the shuttle frame assembly.

083 INTAKE FAN FAULT

1. Sensors cannot detect current in the card cage fan circuit.

   Cycle power. If the message appears, press **Stop**.

2. Power off the printer. Remove the paper guide assembly or pedestal top cover. Disconnect connector P106 from the CMX controller board. Test connector P106/CCF for shorts or opens. (Refer to the Main Wire Harness Test Tables on page 297.)

   Replace components that fail test.

3. Make sure P106/CCF has a good connection at J106 on the CMX controller board.

   Connect P106 to the CMX controller board.

4. Inspect for obstructions of airways and vents.

   Remove obstructions.

5. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

084 POWER SUPPLY 48V FAILED

1. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check that power supply connector P101 is fully seated in connector J101 on the CMX controller board.

   Connect power supply connector P101 to J101 on the CMX controller board.

2. If the printer has the coax/twinax expansion board, check the adapter connection to the CMX controller board.

   Make sure the 60-pin expansion adapter is correctly seated between the CMX controller board and the coax/twinax expansion board.

3. Power on the printer.

   If the message appears, replace the hammer bank logic cable assembly (P108) and the power cable assembly (P105). (Refer to Appendix A.)

4. Power on the printer.

If the message appears, replace the power supply board.

5. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

6. Power on the printer.

   If the message appears, replace shuttle frame assembly.

085 CONTROLLER VOLTAGE

1. Controller Voltage Failure.

   Cycle Power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the flash memory.

3. Power on the printer. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

4. Power on the printer. Run the print job again.

   If the message appears, replace the power supply board.

086 CONTROLLER 15V

1. Controller Voltage Failure.

   Cycle Power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the flash memory.

3. Power on the printer. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board. Also check the resistance of connectors P106/LRIB M and P107/RRIB M. (Refer to the Main Wire Test Tables, page 297.) If ribbon motor resistance is not correct, replace the motor and/or the intermediate cable, if installed.

4. Power on the printer. Run the print job again.

If the message appears, replace the power supply board.

5. Power on the printer.

   If the message appears, replace the shuttle frame assembly.

087 PLATEN OPEN TIMEOUT
CLOSE PLATEN

1. On a coax interface, the forms thickness lever has been open for at least one minute. Load paper.

   Close the forms thickness lever. Press **Stop**.

2. Run a print test. If a platen open or close platen message appears, power off the printer. Remove the paper guide assembly or pedestal top cover. Disconnect connector P107 from the CMX controller board. Check continuity of the platen interlock switch cable from P107 to the switch.

   Replace the platen interlock switch assembly if it fails continuity test. (Refer to Appendix A, Switch Assembly, Platen Interlock.)

3. Check that the platen interlock switch is not loose.

   Tighten the screws securing the platen interlock switch

4. Check the condition and tension of the platen open belt.

   Adjust the platen open belt. Replace the belt if it is damaged.

5. Check the platen open pulley and the platen pulley for looseness.

   Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 9 ± 2 inch-pounds (1.02 ± 0.23 N•m). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.

6. Disconnect connector P106 from the CMX controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables on page 297.)

   Replace the platen open motor if it fails the resistance test.

7. Run a print test.

   If a platen open or close platen message appears, replace the CMX controller board. Record the message and return it with the defective board.

088 CONTROLLER 23.5V

1. Controller Voltage Failure.

   Cycle Power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the flash memory.

3. Power on the printer. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

4. Power on the printer. Run the print job again.

   If the message appears, replace the power supply board.

5. Power on the printer.

   If the message appears, replace the shuttle frame assembly.

089 RIBBON STALL

1. This message occurs when the ribbon fails to move while printing. Check the forms thickness lever: if it is set too tightly it can inhibit ribbon movement.

   Set the forms thickness lever to match the thickness of the paper being used, but not too tightly.

2. Inspect the ribbon guides for ink buildup, which can inhibit ribbon movement.

   Clean the printer.

3. Inspect the hammer bank cover/ribbon mask for bending or damage, which can inhibit ribbon movement.

   Replace the hammer bank cover assembly if it is bent or damaged.

4. Check the platen gap. If the gap is too small, it can inhibit ribbon movement.

   Adjust the platen gap.

5. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check the resistance of connectors P106/LRIB M and P107/RRIB M. (Refer to the Main Wire Test Tables, page 297.)

   If ribbon motor resistance is not correct, replace the motor and/or the intermediate cable, if installed.

6. Power on the printer. Run an Operator Print Test. (See page 135.)

   If the ribbon a RIBBON STALL message appears, replace the CMX controller board. Record the message and return it with the defective board.

090 SHUTTLE COVER OPEN
CLOSE SHUTTLE COVER

1. The shuttle cover is missing, damaged, or not correctly installed. Inspect shuttle cover for warping, damage, or missing magnet. (The magnet covers the sensor housing when the cover is installed.)

   If the shuttle cover is warped, damaged, or the magnet is missing, replace the shuttle cover assembly.

2. Check shuttle cover installation.

   Install the shuttle cover correctly. Make sure the cover lies flat and the two captive screws are fully seated.

3. Power on the printer.

   If the message appears, power off the printer. Remove the paper guide assembly or pedestal top cover. Disconnect P107 on the CMX controller board and check the CVO switch by testing for continuity across pins 18 and 20. (Refer to the Main Wire Test Tables, page 297.) Replace the cover open switch assembly, as required.

4. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

092 RIBBON DRIVER CIRCUIT

1. The CMX controller board does not detect a ribbon drive motor.

   Cycle power. If the message appears, power off the printer. Remove the paper guide assembly or pedestal top cover. Reseat the cable connections of both ribbon drive motors.

2. Power on the printer. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for a ribbon drive motor that will not wind the ribbon.

   If the ribbon will not wind in one or both directions, replace the defective ribbon drive motor(s). If the ribbon winds in both directions, replace the CMX controller board. Record the message and return it with the defective board.

101 UPPER DRIVER SHORT

1. Hammer driver circuits on the CMX controller board are shorted to ground.

   Cycle power. If the message appears, press **Stop**. If the message does not clear, replace the hammer bank logic cable and the hammer bank power cable assemblies.

2. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

3. Power on the printer.

   If the message appears, replace the shuttle frame assembly.

102 LOWER DRIVER SHORT

1. Circuit(s) on the hammer bank or in the hammer bank power cable are shorted to ground.

   Cycle power. If the message appears, press **Stop**. If the message does not clear, replace the hammer bank logic cable and the hammer bank power cable.

2. Power on the printer.

   If the message appears, replace the shuttle frame assembly.

3. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

105 HAMMER COIL <number> OPEN

1. Electrical malfunction of one or more hammer coils.

   Cycle power. If the message appears, replace the shuttle frame assembly.

2. Power on the printer. Run a print test.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

107 HAMMER COIL <number> HOT

NOTE: The printer has sensor circuits that sample the operating temperature of key components of the print mechanism. When higher than normal temperatures are sensed, print speed is automatically reduced by 50% and a COIL HOT message is sent to the LCD to inform the operator. When the coil(s) cool down, print speed automatically returns to 100% and the message clears from the LCD. This message is normal for extremely dense print jobs, such as the Plot Test. If the printer often prints at half speed, it may be operating in a severe environment. A severe environment is one with an ambient temperature at or above above 40° Celsius (104° Fahrenheit) or that is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area or reduce the size and duration of the print jobs.

1. One or more hammer coils are overheating. Inspect the printer environment for severity. (See NOTE above.)

   Advise the user to move the printer to cooler, cleaner location.

2. Check the kinds of print jobs the user is running: look for very dense graphics and layouts.

   Advise the user to run jobs in smaller batches.

3. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check all fan cable connections.

   Connect fan cables.

4. Power on the printer. Verify that all fans operate.

   Replace any fan that does not operate.

5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents.

   Remove any obstructions from vents and airways.

6. Install the paper guide assembly or pedestal top cover. Load paper. Run the “All E’s” print test for 5–10 minutes.

   If the message appears, replace the shuttle frame assembly.

7. Run the “All E’s” print test for 5–10 minutes.

If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

110 STACK OVERFLOW
SEE USER'S GUIDE

1. System stack has run out of room and overflowed into other memory.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

111 STACK UNDERFLOW
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

112 UNDEFINED OPCODE
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

113 PROTECTED INSTRUCTION
SEE USER'S GUIDE

1. Protected Instruction. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

114 ILLEGAL OPERAND ACCESS
SEE USER'S GUIDE

1. Illegal Operand Accessed. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

115 ILLEGAL INSTRUCTION ACCESS
SEE USER'S GUIDE

1. Illegal Instruction Accessed. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

116 ILLEGAL EXTERNAL BUS ACCESS
SEE USER'S GUIDE

1. Illegal External Bus Accessed. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

117 A TO D OVERRUN
SEE USER'S GUIDE

1. The analog-to-digital converter on the CMX controller board has overflowed.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

118 UNDEFINED INTERRUPT
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

119 TCB CORRUPTED
SEE USER'S GUIDE

1. Task Control Block on the CMX controller board has been corrupted.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

120 ACCESS NULL POINTER
SEE USER'S GUIDE

1. The processor tried to access a pointer that contains nothing (null).

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

121 PAPER NOT AT SPEED
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

122 PAPER NOT SCHEDULED
SEE USER'S GUIDE

1. The paper feed process is not scheduling on the CMX controller board, and the printer cannot advance paper.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the MPU cable assembly.

3. Power on the printer. Run the print job again.

   If the message appears, replace the power supply board.

4. Power on the printer. Run the print job again.

   If the message appears, replace the shuttle frame assembly.

5. Power on the printer. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

123 PAPER BUSY TOO LONG
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Run the print job again.

   If the message appears, power off the printer. Remove the paper guide assembly or pedestal top cover. Make sure connectors P106 and P107 are fully seated on the CMX controller board.

3. Power on the printer. Run the print job again.

   If the message appears, replace the shuttle frame assembly.

4. Power on the printer. Run the print job again.

   If the message appears, power off the printer. Make sure the MPU cable, the hammer bank logic cable, and the hammer bank power cable are

undamaged and have good connections. Replace as necessary. (Refer to Appendix A.)

5. Power on the printer. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

124 PAPER FIFO OVERFLOW
SEE USER'S GUIDE

1. Paper First In First Out Overflow. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

125 PAPER FIFO UNDERFLOW
SEE USER'S GUIDE

1. Paper First In First Out Underflow.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Run the print job again.

   If the message appears, power off the printer. Remove the paper guide assembly or pedestal top cover. Make sure connectors P106 and P107 are fully seated on the CMX controller board.

3. Check hammer phasing.

   Try using a lower phasing value; sometimes this message indicates too high a hammer phase value.

4. Power on the printer. Run the print job again.

   If the message appears, power off the printer. Make sure the MPU cable, the hammer bank logic cable, and the hammer bank power cable are undamaged and have good connections. Replace as necessary. (Refer to Appendix A.)

5. Power on the printer. Run the print job again.

   If the message appears, replace the shuttle frame assembly.

6. Power on the printer. Run the print job again.

   If the message appears, replace the power supply board.

7. Power on the printer. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

126 PAPER FEED BAD TABLE
SEE USER'S GUIDE

NOTE: If this message appears during a software download, do the download again. If the message appears on the second try, replace the CMX controller board.

1. The paper feed process on the CMX controller board has a corrupted table.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

127 PAPER FEED ILLEGAL STATE
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

128 PAPER FEED INVALID COMMAND
SEE USER'S GUIDE

1. Paper Invalid Command. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

129 PAPER FEED INVALID PARAMETER
SEE USER'S GUIDE

1. Paper Invalid Parameter. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

130 PAPER FEED PARTLY ENERGIZED
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

131 PAPER FEED INTERRUPT
SEE USER'S GUIDE

1. Unexpected interrupt in the paper feed process on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

132 RIBBON INVALID COMMAND
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

133 RIBBON INVALID STATE
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

134 PLATEN INVALID COMMAND
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

135 PLATEN INVALID STATE
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

136 PLATEN INVALID PARAMETER
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

137 SHUTTLE INVALID COMMAND
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

138 SHUTTLE INVALID PARAMETER
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

139 SHUTTLE OVERSPEED
SEE USER'S GUIDE

1. Firmware error on the CMX controller board.

   Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Remove the shuttle cover. Remove the paper guide assembly or the pedestal top cover. Make sure the MPU cable is not pinched. (Refer to Appendix A, Interconnection Diagram, page 295.)

   Check the resistance of MPU in P107. (Refer to the Main Wire Test Tables, page 297.) Replace the MPU if it fails the test.

3. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

990 MACHINE CHECK

1. Host status message.

   No action required.

998 NON-VOLATILE MEMORY FAILED

1. The non-volatile memory has failed.

   Replace the CMX controller board. (Do NOT attempt to replace NVRAM.)

A97 GRAPHIC CHECK ERROR
PRESS STOP THEN START

1. The printer received a non-printable character over a twinax interface.

   Press **Stop** then **Start**.

BOOT DIAGNOSTICS

1. Non-error status message.

   No action required.

CLEARING PROGRAM FROM FLASH

1. Status message: emulation software successfully loaded into printer RAM and the checksum matched. The old program is now being deleted from flash memory.

   No action required.

DRIVER CIRCUIT BAD

1. The hammer coil count test failed.

   Cycle power. If the message appears, press **Stop**.

2. Power off the printer. Remove the shuttle cover. At the shuttle frame assembly, disconnect the hammer bank logic and power cables. Power on the printer.

   If “HB NOT INSTALLD” appears on the LCD, replace the shuttle frame assembly. If “HB NOT INSTALLD” does not appear on the LCD, replace the CMX controller board.

ENERGY SAVER MODE ACTIVE

1. Status message: the printer is in low-energy idle state, all fans and higher voltages are off, only +5Vdc logic circuits are active.

No action required, but you can press the **Form Feed** key to revive the printer from energy saver mode.

ERROR:
DRAM AT ADDRESS <hex>

1. The printer found a defective memory location.

   Replace the DRAM.

2. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

ERROR: DRAM NOT DETECTED

1. DRAM is defective or missing.

   Check DRAM on the CMX controller board. If present, reseat DRAM; if missing, install DRAM.

2. Power on the printer.

   If the message appears, replace the DRAM.

3. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

ERROR: FLASH DID NOT PROGRAM

1. The printer encountered an error trying to program flash memory.

   Download the program again. If the message occurs again, replace the flash memory.

ERROR: PROGRAM NOT VALID

1. The printer does not see a program in flash memory.

   There is no program in printer memory. Download the emulation.

ERROR: SECURITY PAL NOT DETECTED

1. The security PAL is missing or has failed. Power off the printer. Remove the paper guide assembly or pedestal top cover.

Check the security PAL at location U54 on the CMX controller board. If the PAL is absent, install the correct PAL. If a security PAL is present, replace it.

2. Power on the printer.

   If the message appears, replace the replace the CMX controller board. Record the message and return it with the defective board.

ERROR: SHORT AT ADDRESS XXXX

1. Hardware failure in DRAM or CMX controller circuitry.

   Download the program again. If the message appears again, replace the DRAM. If message occurs with new memory, replace the CMX controller board. Record the message and return it with defective CMX board.

FM HEADER ERROR

1. Frame Header Error. Application software has violated header parameters.

   Not a printer problem. The system administrator should correct applications data or configuration.

HAMMER BANK NOT INSTALLED

1. Self-test routines do not detect hammer coils at printer start-up. Power off the printer. Verify that the shuttle frame assembly is installed.

   Install the shuttle frame assembly.

2. Remove the paper guide assembly or pedestal top cover. Verify that the hammer bank logic cable is connected to connector J108 on the CMX controller board and to the shuttle frame assembly.

   Connect the hammer bank logic cable to connector J108 on the CMX controller board and to the shuttle frame assembly.

3. Power on the printer.

   If the message appears, replace the hammer bank logic cable.

4. Power on the printer.

   If the message appears, replace the shuttle frame assembly.

5. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

HAMMER COIL BAD

#, #, #, #, ... etc.

1. Hammer coil(s) number #, #, etc. failed the current test at power-up. Check that the hammer bank cables are connected.

   Cycle power. If the message appears, replace the shuttle frame assembly. Record the message and return it with the defective assembly.

2. Power on the printer.

   If the message appears, replace CMX controller board. Record the message and return it with the defective board.

LOADING PROGRAM FROM PORT XX%

1. The new emulation program is loading into printer RAM. XX% indicates how much of the program has loaded.

   No action required.

LOADING PROGRAM INTO FLASH

1. The printer has deleted the previous emulation program from flash memory and is loading the new program into flash memory.

   No action required.

NOT READY

1. Printer state message: printer is offline, not in communication with host.

   No action required.

OPERATOR MENU

<first menu item>

1. Non-error status message.

   No action required.

OPERATOR MENU LOCKED

1. Non-error status message.

   No action required.

OPERATOR MENU UNLOCKED

1. Non-error status message.

No action required.

PA1 SELECTED

1. Attach status message.

   No action required.

PA2 SELECTED

1. Attach status message.

   No action required.

P05 DIAGNOSTIC TEST PASSED

1. Non-error status message: the printer passed its memory and hardware initialization tests.

   No action required.

P17 SECURITY VIOLATION

1. Security code of the PAL on the CMX controller board does not match the code of the firmware on the CMX controller board. Remove the paper guide assembly or pedestal top cover. Check that the security PAL is correctly installed. (See Figure 34, page 226.)

   Install correct PAL for the customer's emulations with the notched end facing toward the flash and DRAM SIMM sockets.

2. Run a print test.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

P60 ERROR:
DRAM AT ADDRESS <hex>

1. The printer found a defective memory location.

   Replace the DRAM. (See Figure 34, page 226.)

2. Power on the printer.

   If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

P61 ERROR:

FLASH NOT DETECTED

1. The printer could not find flash memory.

   Check flash memory on the CMX controller board. If present, reseat the flash SIMMs; if missing, install flash SIMMs. (See Figure 34, page 226.)

P62 ERROR:

DC PROGRAM NOT VALID

1. The printer cannot find the data controller program or the validation checksum is corrupt.

   Download the program again. If the message appears, replace all flash memory SIMMs. (See Figure 34, page 226.)

P63 ERROR:

PROGRAM NOT COMPATIBLE

1. The printer is not compatible with the downloaded program.(The user may have tried to load a CMX-compatible diskette in a CBO-controlled printer, or vice versa.)

   Use the correct emulation software option(s) for this model printer. If the printer is an IBM 6404–B01, the controller is a CBO board. If the printer is an IBM 6400, the controller is a CMX board.

P64 ERROR:

CHECKSUM WRONG <hex>

1. The printer received the complete program but the checksum did not match. The data may have been corrupted during download.

   Power off the printer. Download the program again from the beginning. If the messages appears, replace the DRAM. (See Figure 34, page 226.)

2. Download the program using a new software diskette.

   If the messages appears, replace the flash memory. (See Figure 34, page 226.)

3. Download the program.

   If the messages appears, replace the CMX controller board. Record the message and return it with the defective board.

P65 ERROR:

PROGRAM NEEDS MORE FLASH

1. The printer requires more flash memory in order to run the downloaded program.

   Add flash memory or use a smaller emulation program. (See Figure 34, page 226.)

P66 ERROR:

PROGRAM NEEDS MORE DRAM

1. The printer requires more DRAM memory in order to run the downloaded program.

   Add DRAM or use a smaller emulation program. (See Figure 34, page 226.)

P67 ERROR:

WRITING TO FLASH

1. Hardware or software fault in flash memory.

   Replace flash memory. (See Figure 34, page 226.) If message occurs with new memory, replace the CMX controller board. Record the message and return it with the defective board.

P68 ERROR:

EC PROGRAM NOT VALID

1. The printer cannot find the engine controller program or the validation checksum is corrupt.

   Download the program again. If the message occurs again, replace all flash memory SIMMs. (See Figure 34, page 226.)

P69 ERROR:

EC STOPPED AT STATE XXXX

NOTE: If the state is 0000, replace the CMX controller board.

1. Where XXXX is a number from 0000 to 0010. The Engine Controller hung at a process indicated by XXXX. Power off the printer. Remove all flash memory and DRAM SIMMs. Inspect the SIMM sockets on the CMX controller board. (See Figure 34, page 226.)

   If any socket pins are bent or damaged, replace the CMX controller board.

2. Install the flash and DRAM SIMMs, making sure they are fully and correctly seated. Power on the printer. Download the emulation.

   If the message appears, replace the flash SIMM(s). (See Figure 34, page 226.)

3. Power on the printer. Download the emulation.

   If the message appears, replace the DRAM SIMM(s). (See Figure 34, page 226.)

4. Power on the printer. Download the emulation.

   If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

PLEASE WAIT...
RESET IN PROGRESS

1. Status message: the printer finished loading the program into flash memory and is automatically resetting itself.

   No action required.

READY

1. Printer state message: the printer is online.

   No action required.

RESETTING...
PLEASE WAIT

1. Status message: the printer is resetting itself.

   No action required.

RESTORING BOOT CODE

1. Status message when downloading boot code. Code is checked then saved in flash memory.

   No action required.

RIBBON OUT OF INK
CHANGE RIBBON

1. RibbonMinder™ software has determined that the ribbon is out of ink.

   Install a new ribbon and set ribbon life to 100%.

SENDING PROGRAM TO EC PROCESSOR

1. Status message: the printer is loading the engine controller program into the engine controller.

   No action required.

SERVICE

<first service test>

1. Non-error status message.

   No action required.

SOFTWARE ERROR

RECYCLE POWER

1. Application software tried to perform an illegal printer function or damaged logic circuits were detected on the CMX controller board.

   Cycle power. If the message appears, power off the printer.

2. Disconnect the input data line from the host computer. Power on the printer.

   If the message appears, download the emulation software again.

3. Cycle power. Run the print job again.

   If the message appears, replace the CMX controller board. If the message is gone, there is an application software error. Request assistance from your local support group.

TABLE MISMATCH

DOWNLOAD AGAIN

1. An Engine Controller software update is in process.

   Power off the printer. Download the program again from the beginning.

TESTING HARDWARE

PLEASE WAIT

1. Status message when printer runs self-tests and initialization routines.

   No action required.

TOP OF FORM SET

1. Non-error status message.

No action required.

WAITING FOR PROGRAM DOWNLOAD

1. Emulation download mode has been activated, but program download has not yet begun.

   No action required.

Black squares on operator panel display

1. Power off the printer. Remove the paper guide assembly or pedestal top cover. Disconnect the operator panel cable from the panel and from J110 on the CMX controller board. Check continuity of the cable. (See Appendix A.)

   Replace the operator panel cable if it fails continuity test. Connect the cable. Power on the printer. If the symptom appears, replace the operator panel.

2. If the printer has the coax/twinax expansion board, check the adapter connection to the CMX controller board.

   Make sure the 60-pin expansion adapter is correctly seated in the CMX controller board connector J111 and the coax/twinax expansion board.

3. Power off the printer. Make sure the flash memory is seated properly in J10 and J11. Regardless of memory configuration, J11 must be used.

   Reseat flash memory.

4. Power on the printer.

   If black squares appear on the LCD, the flash memory could be blank. Replace the flash SIMM in J11 with a new flash SIMM with the boot program installed.

5. Power on the printer.

   If black squares appear on the LCD, replace the CMX controller board.

Characters or dots are missing, smeared, too light, or too dark

1. Check the forms thickness lever: if it is set too loose or too tightly print quality can be affected.

   Set the forms thickness lever to match the thickness of the paper being used.

2. Check the paper tension between the tractors.

Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension.

3. Inspect the shuttle frame assembly for print chaff, debris, or ink residue that could be causing the problem.

   Clean the shuttle frame assembly.

4. Check the ribbon for folds or tears. Check that the ribbon guides are tight and the ribbon tracks straight across them.

   Rewind or install new ribbon. If the ribbon does not track straight across the ribbon guides, adjust the ribbon guides. If the ribbon guides are loose, tighten them. If the ribbon guides are damaged, replace them.

5. Power off the printer. Remove the shuttle cover. Remove the shuttle frame assembly. Inspect the ribbon mask for bends or deformation that adversely affect paper feeding. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs. Check the shuttle frame assembly for broken hammer springs, hammer tips, or contaminations.

   Replace any damaged hammer spring assemblies. Replace the hammer bank cover assembly if it is deformed or damaged.

6. Check the platen gap.

   Adjust the platen gap.

7. Remove the paper guide assembly or pedestal top cover. Make sure Connectors P105 and P108 have good connections on the CMX controller board. Make sure connectors P04 and P05 have good connections at the shuttle frame assembly.

   Reseat connectors P04, P05, P105, and P108

8. Power on the printer.

   If the problem still occurs, replace the shuttle frame assembly.

9. Power on the printer.

   If the problem still occurs, replace the power supply board.

10. Power on the printer.

    If the problem still occurs, replace the CMX controller board.

CLEAR JAM message instead of LOAD FORMS when printer is out of paper

1. Power off the printer. Remove the paper guide assembly or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket.

Install the paper detector switch assembly.

2. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.

   Connect P106/PMD to J106 on the CMX controller board.

3. Power on the printer. Load paper.

   Replace the paper detector switch assembly if either message appears.

4. Power on the printer. Load paper.

   Replace the CMX controller board if either message appears. Record the message and return it with the defective board.

CLEAR JAM message will not clear and paper does not move

1. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.

   Connect P107/PAPR M to J107 on the CMX controller board.

2. Check the paper feed motor pulley for looseness.

   Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch-pounds (2.82 ± 0.23 N•m).

3. Check the condition and tension of the paper feed timing belt.

   Adjust the paper feed timing belt. Replace the belt if it is damaged.

4. Power on the printer. Load paper. Press **Form Feed** and **View** several times and check that paper moves correctly in both directions.

   Replace the paper feed motor if the message appears or the paper moves erratically.

5. Power on the printer. Press **Form Feed** and **View** several times and check that paper moves correctly in both directions.

   Replace the CMX controller board if the message appears or the paper moves erratically. Record the message and return it with the defective board.

CLEAR JAM message will not clear but paper moves

1. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.

   Connect P106/PMD to J106 on the CMX controller board.

2. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket.

   Install the paper detector switch assembly.

3. Check that the paper detector switch assembly is securely mounted to the mechanism base.

   Tighten the two screws securing the paper detector switch assembly to the mechanism base.

4. Check that the motion detector wheel rotates.

   Replace the paper detector switch assembly if the wheel does not rotate.

5. Power on the printer. Load paper.

   Replace the paper detector switch assembly if the message appears.

6. Power on the printer. Load paper.

   Replace the CMX controller board if the message appears. Record the message and return it with the defective board.

Downloads consistently fail

NOTE: Most download problems are detected by software during the procedure and communicated by LCD messages. If downloads fail consistently with no messages or with erratic messages, suspect a hardware failure.

1. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check the I/O cable connections from the host to the printer. Check the parallel cable connection at J112 on the CMX controller board. Inspect all cables for damaged, bent, broken, or burnt pins.

   Replace any damaged cables. Reconnect all I/O cables; make sure all connections are clean and tight.

2. Remove the flash SIMMs. Inspect the flash SIMM sockets on the CMX controller board.

   If any socket pins are bent or damaged, replace the CMX controller board.

3. Check that customer has the right size SIMMs for the emulation. (See page 226.)

   Install SIMMs that support the emulation software.

4. Power up the printer. Download the emulation.

   If the download fails, activate the Boot Diagnostics Menu (page 142) and run MISC UTILITIES / RUN MEMORY TESTS. If memory fails test, replace the DRAM. If memory tests OK, replace the flash SIMM(s).

5. Power up the printer. Download the emulation.

   If the download fails, replace the CMX controller board.

Flash SIMM won't copy

1. Power off the printer. Remove the flash SIMMs. Inspect the flash SIMM sockets on the CMX controller board.

   If any SIMM socket pins are bent or damaged, replace the CMX controller board.

2. Make sure the blank SIMM is the same size as the SIMM to be copied. Install the SIMMs, making sure they are fully and correctly seated. Power on the printer. From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS. (See page 142.)

   If the DESTINATION NOT DETECTED message appears, the blank SIMM is not a type supported by the boot code on the original SIMM. If SOURCE LARGER THAN DESTINATION appears, the blank SIMM is not large enough to contain the code on the original SIMM. If the SIMM does not copy or the ERROR WRITING TO FLASH message appears, replace the blank SIMM.

3. Power on the printer. From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS.

   If the new SIMM does not copy, replace the CMX controller board.

Horizontal misalignment of characters (Dots or characters move left or right from dot row to dot row or line to line)

1. If dots between alternate dot rows are misaligned, check the hammer phasing.

   Adjust hammer phasing.

2. If the printer is a model 6400–004, –04P, –005, or –05P, check the shuttle speed setting.

   Set the shuttle speed (page 189).

3. Inspect the shuttle frame assembly area for ink residue, paper chaff, or debris.

   Clean the shuttle frame assembly.

4. Check the MPU gap.

Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m).

5. Power up the printer. Run a print test.

   If the symptom is not gone, replace the MPU.

6. Power up the printer. Run a print test.

   If the symptom is not gone, replace the CMX controller board.

7. Power up the printer. Run a print test.

   If the symptom is not gone, replace the shuttle frame assembly.

No power, and the operator panel is blank, and the card cage fan is not running

1. Check that the AC power outlet has power.

   Restore AC power.

2. Unplug the printer AC power cord from the printer (leave it plugged into the power outlet) and check for AC power at the printer end of the cord.

   If there is no power through the AC power cord, replace it. Plug the AC power cord into the printer and power outlet.

3. Remove the paper guide assembly or pedestal top cover. Verify that the AC-in power cable and the AC power input cables are connected to the on/off switch—circuit breaker. (See Figure 51, page 287.)

   Connect the AC-in power supply cable and AC power input cables to the on/off switch—circuit breaker. Make sure all ground connections are clean and tight.

4. Check that AC-in power cable connector P1 is connected to J1 on the power supply board.

   Connect AC-in power cable connector P1 to J1.

5. Check that power supply cable connector P101 is connected to J101 on the CMX controller board.

   Connect power supply connector P101 to J101 on the CMX controller board.

6. Check all cable connections on the CMX controller board.

   Connect all cables.

7. If the printer has the coax/twinax expansion board, check the adapter connection to the CMX controller board.

   Make sure the 60-pin expansion adapter is correctly seated in the CMX controller board and the coax/twinax expansion board.

8. Disconnect AC-in power supply cable connector P1. Set the circuit breaker to 1 (on). Measure AC voltage at pins 1 and 2 of connector P1.

   If no voltage, replace the circuit breaker. If there is voltage, replace the power supply board.

Operator panel blank

1. Power off the printer. Remove the paper guide assembly or pedestal top cover. Check all cable connections into the CMX controller board; make sure the control panel cable is seated in connector J110 on the controller board.

   Connect all cables.

2. If the printer has the coax/twinax expansion board, check the adapter connection to the CMX controller board.

   Make sure the 60-pin expansion adapter is correctly seated in the CMX controller board and the coax/twinax expansion board.

3. Power on the printer. Inspect the operator panel display and cooling fans.

   If the operator panel is blank and the cooling fans come on, replace the operator panel cable assembly and/or the operator panel, as required.

4. Power on the printer.

   If the operator panel is blank and the fans not come on, replace the CMX controller board.

Operator panel display shows garbled, broken characters

1. Remove the paper guide assembly or pedestal top cover. Check cable connections into the CMX controller board. Make sure the control panel cable is seated in connector J110 on the controller board.

   Connect all cables.

2. Make sure the DRAM SIMM(s) is/are seated properly in J15/J16.

   Reseat DRAM SIMM(s).

3. Power on the printer. Inspect the control panel display.

   If the control panel shows broken characters, replace the DRAM.

Operator panel keys do not work

1. Power on the printer. Check the operation of the control panel keys.

   Replace the control panel assembly.

2. Power on the printer. Check the operation of the control panel keys.

   Replace the control panel cable assembly.

3. Power on the printer. Check the operation of the control panel keys.

   Replace the CMX controller board.

Paper feeds poorly

1. Check the forms thickness lever: if it is set too tightly paper feeding can be affected.

   Set the forms thickness lever to match the thickness of the paper being used.

2. Power off the printer. Remove paper. Inspect the paper feed path for obstructions that could snag paper.

   Clear paper feed path of any obstructions.

3. Inspect the tractors and tractor door springs for damage or excessive wear.

   If either tractor is damaged or excessively worn, replace both tractor assemblies.

4. Check the paper feed motor pulley for looseness.

   Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch-pounds (2.82 ± 0.23 N•m).

5. Check the condition and tension of the paper feed timing belt.

   Adjust the paper feed timing belt. Replace the belt if it is damaged.

6. Check the platen gap.

   Adjust the platen gap.

7. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.

   Connect P107/PAPR M to J107 on the CMX controller board.

8. Power on the printer. Load paper. Press **Form Feed** and **View** several times and check that paper moves in both directions.

Replace the paper feed motor if paper does not move in both directions.

9. Power on the printer. Press **Form Feed** and **View** several times and check that paper moves in both directions.

   Replace the CMX controller board if paper does not move in both directions.

Printer does not complete IML

NOTE: Power-on initialization is explained on page 151.

1. Power off the printer. Remove the paper guide or pedestal top cover. Check that all cables are connected to the CMX controller board.

   Reseat all cable connectors on the CMX controller board, especially connectors P106 and P107.

2. If the printer has the coax/twinax expansion board, verify that the correct microcode is loaded in the machine. If the printer does not have the coax/twinax expansion board, go to step 6.

   Download CT emulation software.

3. Power off the printer. Check that the user has enough flash memory installed to handle his emulation software. (See Figure 34 on page 226, and Boot Diagnostics Menu on page 142.)

   Install flash memory and download emulation software.

4. Check the coax/twinax adapter connection to the CMX controller board.

   Make sure that J111 is correctly seated between the CMX controller board and the coax/twinax expansion board.

5. Power up the printer.

   If the printer does not successfully complete IML, replace the coax/twinax expansion board.

6. Power up the printer.

   If the printer does not successfully complete IML, replace the power supply board.

7. Power up the printer.

   If the printer does not successfully complete IML, replace the CMX controller board.

Printer does not detect presence of power stacker
—or—
Stacker not operating

1. Check that the power stacker is enabled under the Printer Control menu. (Refer to the *Setup Guide*.)

   Enable the power stacker under the Printer Control menu. If the power stacker enable/disable option does not appear in the menu, go to the next step.

2. Open the rear cabinet door. Check that the ON/OFF indicator lamp is lit.

   If the ON/OFF indicator is not lit, go to step 3.

   If the ON/OFF indicator is lit, press the ONLINE key and check that the ONLINE indicator lights. If the ONLINE indicator comes on, the stacker is detected by the printer. If the ONLINE indicator does not come on, go to step 4.

3. a) Power off the printer.
   b) Unfasten the cable clamp holding the stacker control panel cables.
   c) Disconnect the stacker power cable from the back of the stacker control panel. (See Figure 61, page 380.)
   d) Locate pin 1 of connector P106. (See the cable assembly drawing in Appendix A, page 326.)
   e) Power on the printer.
   f) At connector P106 check for +48 volts DC between pins 1 and 2 and +5 volts DC between pins 3 and 4.

   If the voltages are correct, replace the stacker control panel. If the voltages are not correct, power off the printer, remove the paper guide assembly, and disconnect the stacker power cable from the CMX controller board. (See Figure 66, page 384.) Check the continuity of the stacker power cable between P105 and P106. If the cable fails the continuity test, replace it. If the cable is OK, replace the CMX controller board.

4. Power off the printer. Remove the paper guide assembly. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Figure 61, page 380). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)

   Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

5. Power on the printer. Check that the ONLINE indicators lights on the stacker control panel.

If the ONLINE indicator does not light, replace the stacker control panel.

6. Power on the printer. Check that the ONLINE indicators lights on the stacker control panel.

   If the ONLINE indicator does not light, replace the CMX controller board.

Printer does not print self tests

1. Power off the printer. Remove the paper guide assembly or pedestal top cover. Disconnect the control panel cable from connector J110 on the CMX controller board. Disconnect the control panel cable from the control panel. Check continuity of the control panel cable assembly.

   Replace the control panel cable assembly if it fails continuity test.

2. Connect the control panel cable assembly to J110 on the CMX controller board and to the control panel. Power on the printer. Load paper. Run a self test.

   If the self test does not run, replace the control panel assembly.

3. Power on the printer. Run a self test.

   If the self test does not run, replace the CMX controller board.

Reverse paper feed: platen does not open

1. Raise the forms thickness lever and check that the platen opens.

   If the platen opens with difficulty, inspect for and remove jams or obstructions.

2. Check the platen open pulley and the platen pulley for looseness.

   Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 9 ± 2 inch-pounds (1.02 ± 0.23 N•m). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.

3. Check the condition and tension of the platen open belt.

   Adjust the platen open belt. Replace the belt if it is damaged.

4. Check the platen gap.

   Adjust the platen gap.

5. Power off the printer. Remove the paper guide assembly. Disconnect connector P106 from the CMX controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables on page 297.)

Replace the platen open motor if it fails the resistance test.

6. Power on the printer. Press **Form Feed** and **View** several times and check that paper moves in both directions.

   Replace the CMX controller board if the platen does not open during paper reverse.

Randomly misplaced dots

1. Power off the printer. Check the platen gap.

   Adjust the platen gap.

2. Remove the paper guide assembly or pedestal top cover. On the left rear wall of the card cage, make sure the nut which secures the line filter ground line and the AC In Power Supply cable lead to the ground stud is tight. (See Figure 51, page 287.)

   Tighten the nut on the ground stud.

3. Disconnect the AC power cord and check the ground leads for continuity.

   Replace the AC power cord if it fails continuity test.

4. Make sure the printer is plugged in to a grounded power outlet. Power up the printer. Run a print test.

   If the problem occurs, replace the hammer bank logic cable.

5. Power up the printer. Run a print test.

   If the problem occurs, replace the flash memory and DRAM. Download the emulation software again.

6. Power up the printer. Run a print test.

   If the problem occurs, replace the CMX controller board.

7. Power up the printer. Run a print test.

   If the problem occurs, replace the power supply board.

8. Power up the printer. Run a print test.

   If the problem occurs, replace the shuttle frame assembly.

Ribbon folding or feed problems

1. Check that both ribbon spools are fully seated on the ribbon hubs and the ribbon runs between the ribbon mask and hammer bank cover.

   Install the ribbon correctly.

2. Check that the ribbon spools are not rubbing against the shuttle cover assembly.

   Install the shuttle cover assembly correctly, so that the ribbon spools do not rub against it.

3. Inspect the paper print path for paper chaff, ink residue, and debris.

   Clean the shuttle frame assembly.

4. Power on the printer. Run a print test and observe ribbon movement across the left and right ribbon guides.

   Adjust the right and left ribbon guides.

5. Observe ribbon movement at both left and right ribbon posts as the metal end strip crosses each ribbon post.

   If the metal strip moves past either post without reversing the direction of the ribbon, power down the printer. Remove the paper guide assembly or pedestal top cover. Reseat connectors P106/LRP and P107/RRP on the CMX controller board.

6. While shorting across each ribbon post with the ribbon metal strip or a screwdriver, check for continuity in connector P106/LRP pins 10 and 12, and connector P107/RRP pins 14 and 16. (Refer to the Main Wire Harness Test Tables on page 297.)

   Replace a ribbon post that fails the continuity test.

7. Check the platen gap.

   Adjust the platen gap.

Shuttle does not move

1. Power down the printer. Remove the shuttle cover. Check the MPU gap.

   Adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m).

2. Check that the MPU cable is connected to J03 on the mechanism base. Check that the shuttle motor cable is connected to J02 on the mechanism base.

   Connect the MPU and the shuttle motor cables.

3. Remove the paper guide assembly or pedestal top cover. Check that the shuttle motor drive cable is connected to J116 on the CMX controller board.

   Connect the shuttle motor drive cable.

4. Check the platen gap.

   Adjust the platen gap.

5. Inspect the ribbon mask for bends or deformation that snag and interfere with shuttle movement. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs.

   Reinstall the hammer bank cover assembly. Replace a damaged or deformed hammer bank cover assembly.

6. Check continuity of the shuttle motor drive cable assembly.

   Replace shuttle motor drive cable assembly if it fails continuity test.

7. Power up the printer. Run a Shuttle Slow or Shuttle Fast test.

   If the shuttle does not move, replace the shuttle frame assembly.

8. Power up the printer. Run a Shuttle Slow or Shuttle Fast test.

   If the shuttle does not move, replace the power supply board.

9. Power up the printer. Run a Shuttle Slow or Shuttle Fast test.

   If the shuttle does not move, replace the CMX controller board.

Shuttle is noisy

1. Check the bolts securing the mechanism base to the base pan.

   Tighten the mechanism base mounting bolts if they are loose enough to permit movement of the mechanism base.

2. Remove the shuttle cover. Check the shuttle frame assembly mounting/clamp screws for looseness.

   Torque the 5/32 inch socket head clamp screws to 20 ± 2 inch-pounds (2.26 ± 0.23 N•m). Torque the center captive 5/32 inch socket head screw to 20 ± 2 inch-pounds (2.26 ± 0.23 N•m).

3. Inspect the shuttle area for loose hardware.

   Tighten loose hardware.

4. Check that the hammer bank cover assembly is correctly installed, that it has not slipped off the mounting pegs. Check that the ribbon mask has not partially separated from the hammer bank cover. Check for debris trapped between the ribbon mask, hammer bank cover, and hammer bank.

Clean the shuttle frame assembly and hammer bank cover assembly if you find debris. Replace the hammer bank cover assembly if you find any damage to the ribbon mask or hammer bank cover.

5. Power up the printer. Run a shuttle test.

   Replace the shuttle frame assembly if it is noisy or rattles.

Stacker chatters at upper or lower limit

1. Check for obstructions preventing elevator movement.

   Remove obstructions.

2. Check for misaligned stacker rails

   Adjust the stacker rails if they are not vertical and parallel.

3. Move the elevator up and down by hand. Check that the limit switches are tripped when elevator reaches top and bottom of travel.

   If necessary, gently bend contact arms to adjust limit switches. If you cannot adjust a switch that requires adjustment, replace it.

4. Power on the printer. Operate the power stacker. (Refer to the *Operator's Guide*.) While the stacker is operating, check that:
   a) all motors are operating
   b) the paddles are rotating
   c) the elevator moves smoothly and without obstruction
   d) the timing belts are undamaged and the belt pulleys are not slipping
   e) the extension springs are attached and undamaged (not bent or stretched)
   f) the drive rollers are not damaged
   g) the constant force springs are tightly mounted and undamaged

   Tighten pulley setscrews and/or replace damaged components as necessary.

Stacker does not stack properly
—or—
Stacker elevator does not move

1. Check for obstructions preventing elevator movement.

   Remove obstructions.

2. Check for misaligned stacker rails

   Adjust the stacker rails if they are not vertical and parallel.

3. Power on the printer. Operate the power stacker. (Refer to the Operator's Guide.) While the stacker is operating, check that:

a) all motors are operating
b) the paddles are rotating
c) the elevator moves smoothly and without obstruction
d) the timing belts are undamaged and the belt pulleys are not slipping
e) the extension springs are attached and undamaged (not bent or stretched)
f) the drive rollers are not damaged
g) the constant force springs are tightly mounted and undamaged

Tighten pulley setscrews and/or replace damaged components as necessary.

4. Check the stacker limit switches. (See page 129.)

   If the limit switches are OK, go to the next step.

5. Check the stacker motors. (See page 130.)

   If the stacker motors are OK, go to the next step.

6. Remove the paper guide assembly. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Figure 61, page 380). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)

   Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

Stacker elevator moves by itself

1. Power off the printer. Inspect all stacker LEDs for dust, chaff, or dirt. (See Figure 85 through Figure 87, pages 406 through 410.)

   Clean the stacker LEDs and the sight tubes in the LED mounts.

2. Power on the printer.

   If the stacker elevator moves by itself, replace the stacker LEDs. (See Figure 85 through Figure 87, pages 406 through 410.)

Stacker limit switch check

NOTE: This procedure tests the motion limit switches at the top and bottom of the vertical rails. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this procedure, return to the procedure that sent you here.

1. Power off the printer. Open the rear cabinet door. Unload the power stacker. Move the elevator up and down by hand, checking that it moves smoothly and without chattering or shuddering.

   Eliminate causes of chattering or shuddering. (E.g., loose, damaged, or broken constant force springs, bent or misaligned rails, obstructions, etc.)

   NOTE: If the elevator assembly or the rails are bent or damaged, you must replace the entire power stacker assembly.

2. Move the elevator up and down by hand. Check that the limit switches are physically tripped when elevator reaches top and bottom of travel.

   If necessary, gently bend the contact arms to adjust limit switches. If you cannot adjust a switch that requires adjustment, replace it.

3. a) Unfasten the cable clamp holding the stacker control panel cables.
   b) Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker control panel. (See Figure 61, page 380.)
   c) Locate pin 1 of connector P107. (See the cable assembly drawing in Appendix A, page 327.)
   d) Check the stacker rail cable and limit switches for continuity and shorts. Check continuity of the switch when open and closed. (See the power stacker control panel PCBA pinout drawing on page 304. STK FULL is the upper limit switch, STK LIMIT is the bottom switch.)

   Replace the stacker rail cable if it is damaged or fails continuity test. Replace any switch that fails continuity test.

Stacker motor check

NOTE: This procedure tests the four stacker motors and their cables. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this procedure, return to the procedure that sent you here.

1. a) Power off the printer.
   b) Open the rear cabinet door.
   c) Unfasten the cable clamp holding the stacker control panel cables.
   d) Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker control panel. (See Figure 61, page 380.)
   e) Disconnect stacker frame cable connector P102 from connector J4 on the rear of the stacker control panel. (See Figure 61, page 380.)
   f) Locate pin 1 of connector P102 and connector P107. (See the cable assembly drawings in Appendix A, pages 324 and 327.)
   g) Check both cables for pin damage, continuity, and shorts. Check all motors for

15.2 ± 1.5 Ohms on both phases. (Refer to the power stacker control panel PCBA pinout drawing on page 304.)

Replace any cable that is damaged or fails continuity test.
Replace any motor that fails the resistance test.

TOF is lost repeatedly

1. Check that the customer is setting the forms length to match the size paper used.

   Set the forms length to match the length of paper being used.

2. If the customer is using multi-part forms, check that the forms thickness lever is not being set too tightly.

   Set the forms thickness lever to match the thickness of paper and provide satisfactory print quality, but not too tightly.

3. Check the paper feed motor pulley for looseness. Make sure the correct pulley is being used: it should have 25 teeth.

   Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch-pounds (2.82 ± 0.23 N•m). Replace the paper feed pulley if it does not have 25 teeth.

4. Check the condition and tension of the paper feed timing belt.

   Adjust the paper feed timing belt. Replace the belt if it is damaged.

5. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.

   Connect P107/PAPR M to J107 on the CMX controller board.

6. Power on the printer. Load paper and set TOF. Press **Form Feed** and **View** several times and check that paper returns to TOF.

   Replace the paper feed motor if paper does not return to TOF.

7. Power on the printer. Press **Form Feed** and **View** several times and check that paper returns to TOF.

   Replace the CMX controller board if paper does not return to TOF.

Vertical misalignment of characters:
1. Dots or characters move up or down from dot row to dot row or line to line
2. Incorrect spacing from dot row to dot row or line to line
3. Characters randomly compressed and/or enlarged

1. Load paper. Press **Form Feed** and check that paper feeds smoothly. Press **View** to verify that paper moves in both directions. Check the forms thickness lever: if it is set too loose or too tightly print quality can be affected.

   Set the forms thickness lever to match the thickness of the paper being used.

2. Check the paper feed motor pulley for looseness.

   Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch-pounds (2.82 ± 0.23 N•m).

3. Check the condition and tension of the paper feed timing belt.

   Adjust the paper feed timing belt. Replace the belt if it is damaged.

4. Check the platen gap.

   Adjust the platen gap.

5. Inspect the tractors and tractor door springs for damage or excessive wear.

   If either tractor is damaged or excessively worn, replace both tractor assemblies.

6. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.

   Connect P107/PAPR M to J107 on the CMX controller board.

7. Power on the printer. Load paper. Run a print test.

   If the problem occurs, replace the paper feed motor.

8. Run a print test.

   If the problem occurs, replace the CMX controller board.

9. Run a print test.

   If the problem occurs, replace the power supply board.

Communications Failures

Many host–printer communications problems are complex. With the exception of a defective interface cable, most communications problems are not a result of a hardware failure. They usually result from an incompatible configuration of the host computer system, network (LAN, print server, controller, multiplexer, etc.), or the printer. Sometimes the print application program itself is at fault.

If you have limited communications background experience, and the cause of the problem is not readily apparent, do the following:

1. Print out the printer configuration.
2. Obtain a copy of the Device Host Configuration if possible.
3. Call your support group for assistance in problem analysis.

If you cannot obtain support, or you have previous experience solving host–printer communications problems, the following additional information is provided.

You can quickly check the ASCII portion of the printer logic by sending a plain text file from a PC to the printer via the parallel or serial port. For a description of each of the ASCII interfaces, refer to the *Setup Guide*.

Table 4. Common Communications Problems

Problem	Interface	Common Causes
Fails to print from host –OR– Prints incorrect characters –OR– Prints extra characters –OR– Drops characters	parallel	– Interface cable defective – Host/Network configuration – Printer logic – Terminating Resistors
	serial	– Host/Printer interface cable pinouts incompatible – Host/Printer/Network configuration – Set DTR and RTS both True – Interface cable defective – Printer logic
	twinax	– Interface cable defective – Host–Printer definition – Controller/Network configuration – Printer logic
	coax	– Interface cable defective – Controller/Network configuration – Printer logic

Operator Print Tests

A set of print tests is included in the configuration menu structure for use as diagnostic tools. These are called the “Operator Print Tests” because they are available to the user. You can use these print tests to check the print quality and basic operation of the printer.

The Operator Print Tests are summarized below.

NOTE: Under the description of some tests is a list of items that may need to be adjusted or replaced if the test produces a bad print pattern. The items are listed in the order you should check them: simplest items first, complex items last.

- **Printer Demonstration** Prints a sample page showing every print mode, font, and pitch available in the printer.
- **Print Error Log** Prints the contents of the error log. The error log automatically records certain unit check conditions in a buffer in NVRAM that stores up to 50 messages. The most recent message is stored at the top of the list, the oldest message at the bottom of the list. If more than 50 messages occur before the log is cleared, the oldest messages are deleted, so that the log never contains more than 50 messages.
- **Ripple Print** A “sliding” alphanumeric pattern useful for identifying missing or malformed characters, improper vertical alignment, or vertical compression.

  Hammer bank cover
  Hammer spring
  Shuttle frame assembly

- **All E’s** A pattern of all uppercase letter E’s useful for identifying missing characters, misplaced dots, smeared characters, improper phasing, or light/dark character variations.

  Ribbon
  Splined shaft skew adjustment
  Hammer bank cover
  MPU sensor
  Hammer springs
  Hammer coils (shuttle frame assembly)

- **All H’s** A pattern of all uppercase letter H’s useful for detecting missing characters or dots, smeared characters, or improper phasing.

Ribbon
Hammer bank cover
MPU sensor
Hammer springs
Hammer coils (shuttle frame assembly)

- **All E's + FF** A pattern of all E's repeated for ten lines and followed by a form feed to the top of the next page. This test is useful for identifying paper motion or paper feed problems.

  Hammer bank cover
  Power supply board
  Paper motion sensor or cable
  Paper feed belt or motor
  Splined shaft bearings
  Tractors or tractor belts

- **Underlines** An underline pattern useful for identifying hammer bank misalignment.

  Hammer bank cover
  Hammer tips
  Paper feed belt or motor
  Splined shaft bearings
  Tractor bearings or belts

Selecting and Running Operator Print Tests

Step	Key	Displayed Result	Notes
1.	Make sure that the printer ribbon is installed in the printer and the printer is powered on and is loaded with paper.		
2.	Press: Stop	NOT READY	Places the printer in Not Ready mode.
3.	Press: Scroll ↑ + Scroll ↓	OPERATOR MENU UNLOCKED	Press both keys at the same time. Unlocking the **Enter** key allows you to test your printer.
4.	Press: Menu	OPERATOR MENU PRINTER CONTROL	First of the series of configuration menus.
5.	Press: Scroll ↑ UNTIL	OPERATOR MENU OPERATOR PRINT TESTS	Advances to the Operator Printer Tests menu.
6.	Press: Enter	OPERATOR PRINT TESTS PRINTER DEMONSTRATION*	Advances to Printer Demonstration, the first option in Operator Printer Tests menu.
7.	Press: Scroll ↑ UNTIL	OPERATOR PRINT TESTS [TEST NAME]	Cycles through the list of Printer Tests. Stop when the name of the test you wish to run displays.
8.	Press: Enter	OPERATOR PRINT TESTS [TEST NAME]	The printer test you have selected starts printing.
9.	Press: Stop	NOT READY	The printer test stops printing.

Customer Engineer (CE) Tests

A set of printer tests is included in the configuration menu structure for use as maintenance tools. These are called “Customer Engineer Tests” (CE Tests) because they are for your use—they are not available to the user through his documentation. You will use these tests in various troubleshooting and adjustment procedures.

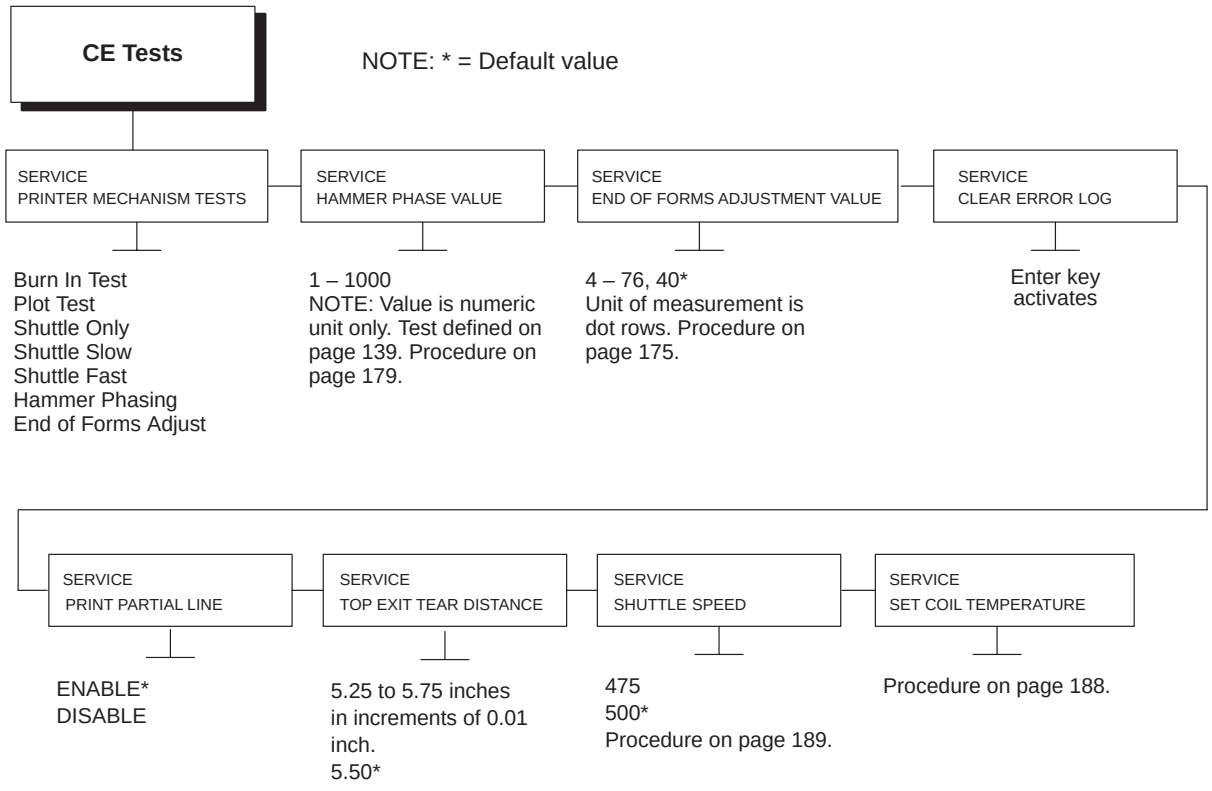


Figure 18. CE Tests Menu

The CE Tests shown in Figure 18 are summarized below:

Printer Mechanism Tests:

- **Burn In Test** Use of this test is *not recommended*. This test is used by the manufacturer to burn in the printer prior to shipment, and has no value as a maintenance tool.
- **Plot Test** Prints all dot positions, creating a solid black band. Exercises the shuttle and hammer bank at maximum capacity.

Power Supply board
Hammer bank cover
Hammer springs
Hammer coils (the shuttle frame assembly)

- **Shuttle Only** This test runs only the shuttle.
- **Shuttle Slow** Verifies proper operation by exercising the shuttle and ribbon mechanisms at low speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Fast** Verifies proper operation by exercising the shuttle and ribbon mechanisms at high speed. You can also use this test to check ribbon tracking and reversing.
- **Hammer Phasing** A hammer timing parameter that permits you to adjust the vertical alignment of dots in character printing.
- **End of Forms Adjust** A vertical comb pattern used to determine the number of dot rows from the completion of a paper out fault to the end of the paper.

Hammer Phase Value:

The hammer phase value is a timing parameter that permits you to adjust the vertical alignment of dots in character printing. The numerical units are relative; they do not represent a physical measurement or value. There is no “correct” value or range.

The factory prints the initial phase value on the aluminum casting of the shuttle assembly, next to the motor housing. Use this value as your starting point when adjusting hammer phasing.

End of Forms Adjustment Value:

This parameter determines where on the paper the printer will stop printing when an out of paper fault is detected. The unit of measurement is dot rows. The number of dot rows may be adjusted up or down 1/2 inch from the factory default of 40 dots.

Clear Error Log:

This menu selection enables you to delete the stored contents of the error log. The error log automatically records certain unit check conditions in a buffer in NVRAM that stores up to 50 messages. The most recent message is stored at the top of the list, the oldest message at the bottom of the list. If more than 50 messages occur before the log is cleared, the oldest messages are deleted, so that the log never contains more than 50 messages.

Print Partial Line:

If the final line of a data stream has no line feed or carriage return character it is retained in the buffer. DISABLE holds the line in the buffer; ENABLE permits the line to be printed after a timeout.

Top Exit Tear Distance:

This parameter allows adjustment in 0.01 inch increments of the final location of page perforations when top paper exit is used.

Shuttle Speed:

Sets shuttle speed in 6400–004, –04P, –005, and –05P printers. See page 189.

Set Coil Temperature:

An automatic sequence in printer software that recalibrates hammer coil temperature. This procedure applies only to 6400–014 and 6400–15 printers. See page 188.

Selecting and Running CE Tests

Step	Key	Displayed Result	Notes
1.	Make sure that the printer ribbon is installed in the printer and the printer is powered on and is loaded with paper.		
2.	Press: Stop	NOT READY	The printer must be in NOT READY state to access the CE Tests.
3.	Press: Scroll ↑ + Scroll ↓ + Return + Enter	SERVICE PRINTER MECHANISM TESTS	Press all four keys at the same time.
4.	Press: Enter	PRINTER MECHANISM TESTS Burn In Test	Press **Enter** to view the different mechanism tests.

Step	Key	Displayed Result	Notes
5. Press:	Scroll↑ UNTIL	PRINTER MECHANISM TESTS Plot Test	Cycles through the list of mechanism tests. Stop when the name of the test you wish to run displays.
6. Press:	Scroll↑ + Scroll↓	OPERATOR MENU UNLOCKED	Press both keys at the same time. You must unlock the **Enter** key to run a test.
7. Press:	Enter	Plot Test Running	The test starts. See Chapter 6 for special instructions in the use of the Hammer Phasing and End of Forms Adjust tests.
8. Press:	Stop –OR– Start	(NOT) READY	**Stop** halts the test, exits the menu, and puts the printer in the NOT READY state. **Start** halts the test, exits the menu, and puts the printer in the READY state.

Boot Diagnostics Menu

Printer boot-up software contains a menu structure that you can access by holding down the **Eject/Restore** and **Stop** keys while powering up the printer. These menus are not intended for the end user, but provide useful information for manufacturing and maintenance personnel. The boot diagnostic menu structure is depicted in Figure 19.

To exit the hidden diagnostic menu, you must recycle power.

Activating the Boot Diagnostic Menu

1. Set the printer power switch to O (off).
2. Press and hold down the **Eject/Restore** and **Stop** keys.
3. While holding the **Eject/Restore** and **Stop** keys, set the printer power switch to 1 (on).
4. When “BOOT DIAGNOSTICS / PRESS ENTER” appears on the LCD, release the **Eject/Restore** and **Stop** keys.
5. Press the **Enter** key. Menu options are shown in Figure 19.

Exiting the Boot Diagnostic Menu

Method 1: Reset the printer from the Menu

1. Using the directional keys, move to the MISC UTILITIES / RESET PRINTER menu option. (See menu map on page 143.)
2. Press the **ENTER** key.

Method 2: Cycle power

1. Power off the printer.
2. Wait 15 seconds.
3. Power on the printer.

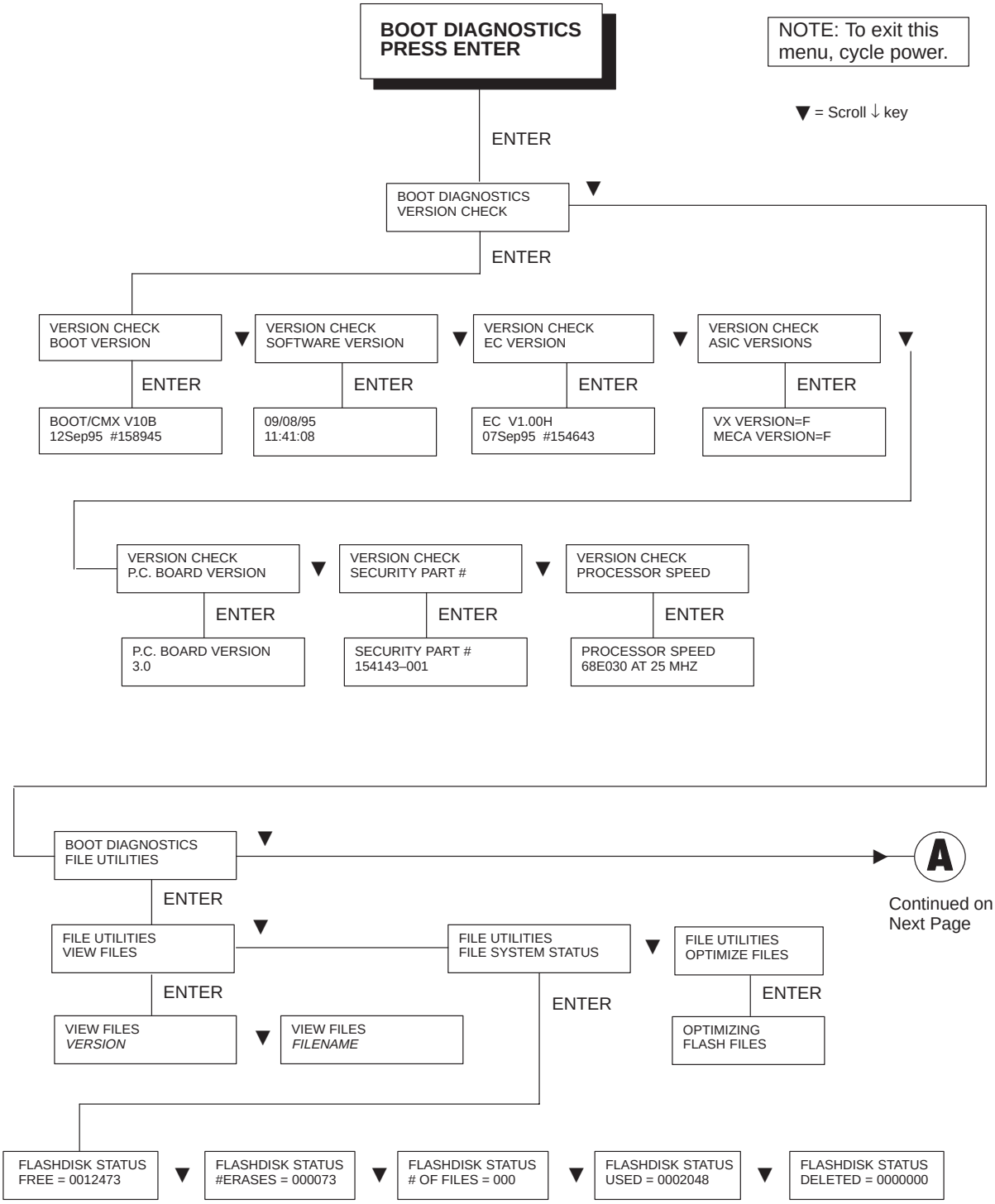


Figure 19. Boot Diagnostics Menu

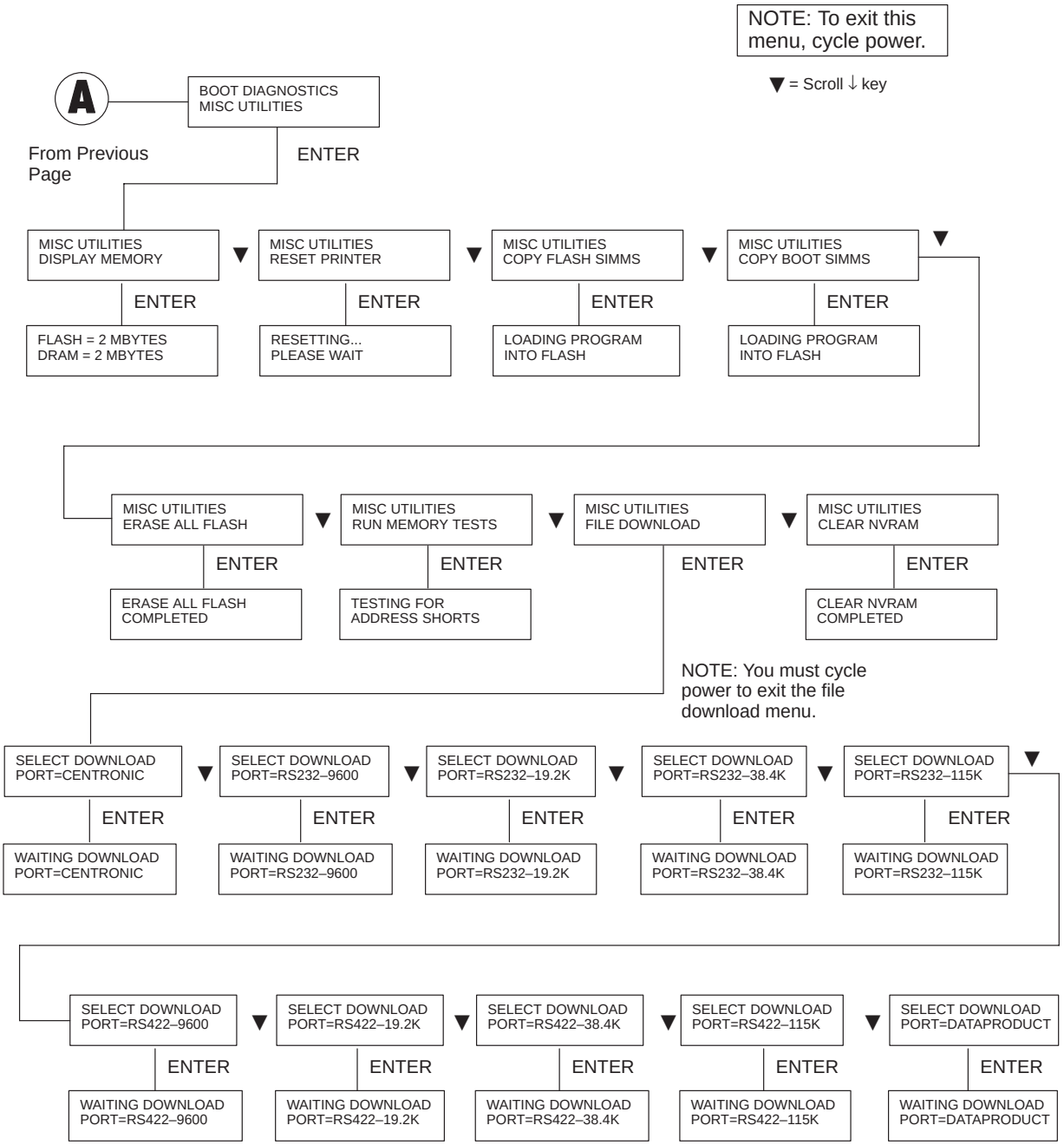


Figure 19. Boot Diagnostics Menu (continued)

Hex Code Printout

A hex code printout (“hex dump”) prints every ASCII character received from the host computer with its corresponding two-digit hexadecimal code. Hex dumps can be used to troubleshoot printer data reception problems by comparing the printed hex data to the data sent from the host.

In a hex dump, every character is printed as its assigned ASCII symbol and as the hexadecimal value of the character. A character that does not have a printed symbol (for example, a control character) is printed as a period (.) and the hex value of the control character.

If the printer is using a parallel interface, the letter p before a hex code indicates an active Paper Instruction (PI) line and a blank space before a hex code indicates an inactive PI line.

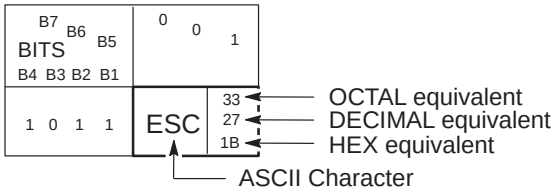
To convert an ASCII character to its corresponding hex code, or vice-versa, refer to the ASCII code chart on page 147.

Step		Key		Displayed Result	Notes
1.	Press:	Stop		NOT READY	Places the printer in Not Ready mode.
2.	Press:	Scroll ↑ +	Scroll ↓	OPERATOR MENU UNLOCKED	Press both keys at the same time. Unlocking the **Enter** key allows you to test the printer.
3.	Press:	Menu		OPERATOR MENU PRINTER CONTROL	First of the series of configuration menus.
4.	Press:	Enter		PRINTER CONTROL INTERFACE SELECTION	Moves down to the Interface Selection option.
5.	Press:	Scroll ↑	UNTIL	PRINTER CONTROL HEX PRINT MODE	Moves down to the Hex Print Mode option.

Step	Key	Displayed Result	Notes
6. Press:	Enter	HEX PRINT MODE DISABLE*	Moves down to Disable, the active option.
7. Press:	Scroll ↑	HEX PRINT MODE ENABLE	Moves down to Enable, the alternate option.
8. Press:	Enter	HEX PRINT MODE ENABLE*	Asterisk (*) indicates this choice is now active.
9. Press:	Stop	NOT READY	Returns the printer to Not Ready mode.
10. Press:	Scroll ↑ + Scroll ↓	OPERATOR MENU LOCKED	Press both keys at the same time to relock the **Enter** key.
11. Press:	Start	READY	Puts the printer in READY mode.

ASCII Character Set

KEY



B7 B6 B5 / BITS B4 B3 B2 B1	ROW	0 0 0 COLUMN 0		0 0 1 1		0 1 0 2		0 1 1 3		1 0 0 4		1 0 1 5		1 1 0 6		1 1 1 7	
0 0 0 0	0	NUL	0 0 0	DLE	20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0 0 0 1	1	SOH	1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0 0 1 0	2	STX	2 2 2	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0 0 1 1	3	ETX	3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0 1 0 0	4	EOT	4 4 4	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0 1 0 1	5	ENQ	5 5 5	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0 1 1 0	6	ACK	6 6 6	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0 1 1 1	7	BEL	7 7 7	ETB	27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1 0 0 0	8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1 0 0 1	9	HT	11 9 9	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1 0 1 0	10	LF	12 10 0 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1 0 1 1	11	VT	13 11 0 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1 1 0 0	12	FF	14 12 0 C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
1 1 0 1	13	CR	15 13 0 D	GS	35 29 1D	–	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1 1 1 0	14	SO	16 14 0 E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
1 1 1 1	15	SI	17 15 0 F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F

Printer Information Menu

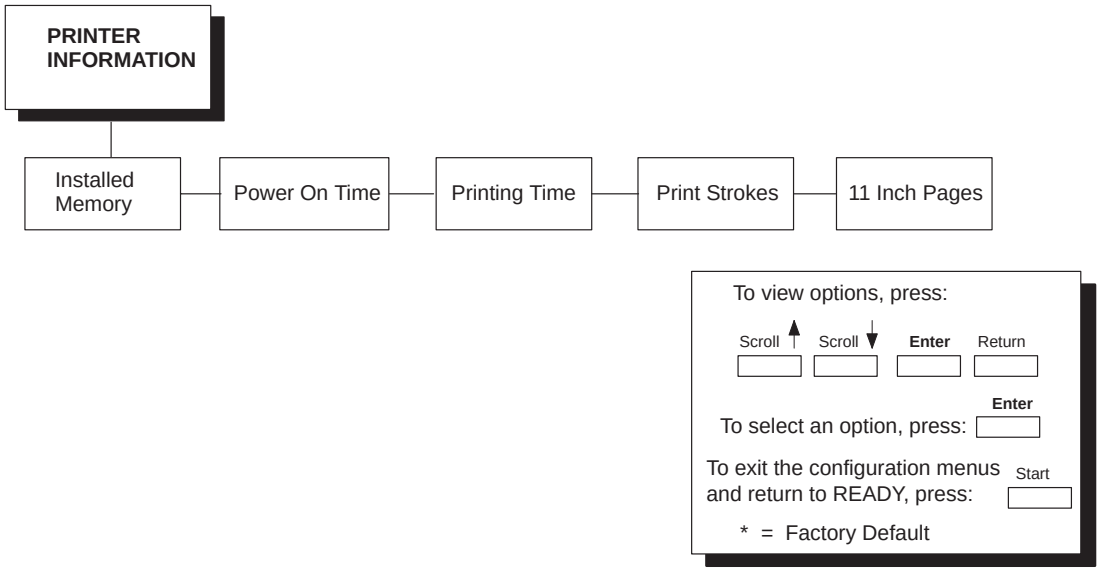


Figure 20. Printer Information Menu

You can view various printer statistics, such as hours of usage, and refer to these figures for preventive maintenance purposes. Printer statistics accumulate continuously; they do not reset when you power off the printer.

All of the printer statistics are set to zero at the factory after burn-in testing.

Installed Memory: Displays the amount of RAM installed in the printer in megabytes.

Power-on Time: The cumulative time in hours the printer has been powered on. The range is 0 to 30,000 hours.

Printing Time: The cumulative time in hours the printer has actually been printing. The range is 0 to 30,000 hours.

Print Strokes: The cumulative number of back-and-forth shuttle strokes the printer has printed during normal operation. The range is 0 to 4,000,000,000 shuttle strokes.

11 Inch Pages: The cumulative number of pages the printer has printed. The range is 0 to 363,000,000 pages.

Displaying Printer Information

Step	Key	Displayed Result	Notes
1.	Power on the printer.		
2.	Press: Stop	NOT READY	Places the printer in Not Ready mode.
3.	Press: Scroll ↑ + Scroll ↓	OPERATOR MENU UNLOCKED	Press both keys at the same time. Unlocking the **Enter** key gives access to configuration menus.
4.	Press: Menu	OPERATOR MENU PRINTER CONTROL	First of the series of configuration menus.
5.	Press: Scroll ↑ UNTIL	OPERATOR MENU PRINTER INFORMATION	Advances to the Printer Information menu.
6.	Press: Enter	PRINTER INFORMATION INSTALLED MEMORY	Advances to Installed Memory, the first of the Printer Information menus.
7.	Press: Scroll ↑ UNTIL	PRINTER INFORMATION [MENU NAME]	Stop when you see the name of the menu you wish to display.
8.	Press: Enter	[MENU NAME] [STATISTIC/INFORMATION]	The menu you selected displays accumulated statistics or printer information.
9.	Press: Stop	NOT READY	Puts the printer in NOT READY mode.

Soft vs. Hard Reset

Soft Reset

A soft(ware) reset clears printer memory then loads the power-up configuration into memory. (The procedure for saving configurations is described in the *Setup Guide*.) It is called a soft reset because no hardware is tested. All diagnostic and initialization tests are bypassed and memory is simply refreshed with the power-up printer configuration.

Put the printer in the NOT READY state to do a soft reset:

1. Press the **Stop** key to put the printer in the NOT READY state.
2. Press the **Stop + Enter** keys.
   The LCD displays “STANDBY...”, “SOFT RESET” while the printer loads the power-up configuration.

Hard Reset (“Cycle Power”)

A hard(ware) reset is a power shutdown and restart that runs all initialization and diagnostic routines. This is also called “cycling power.”

1. Set the printer power switch to O (off).
2. Wait 15 seconds.
3. Set the printer power switch to 1 (on).

NOTE: A hard printer reset causes the +48V power supply (fans, motors, etc.) to shut down in 1 to 5 seconds, depending on the amount of memory installed on the controller board.

The Power On Sequence

This section describes the normal sequence of events from the time the power switch is set to 1 until READY (or NOT READY, if so configured by the user) appears on the LCD.

Use this sequence as a reference baseline to help you isolate problems that occur before the printer completes its boot and initialization routines.

The power on sequence consists of two sets of routines:
1. CMX controller board handshake sequences (DC hardware initialization)
2. DC software initialization and power up

The routines are listed below, in order of occurrence.

CMX Controller Board Handshake Sequences

- **Processor Alive** — The green LED marked CR1 on the CMX controller board is turned on to indicate that the processor received a valid reset vector and the first instructions to the processor are correct. This LED is used to report all DC errors and states.
- **Test VX Data Bus** — A walking zero and one test verifies that all 32 data lines from the VX bus to the processor are connected. If a bad line is detected, a 4–1–1–XX blink code is sent to the LED on the CMX controller, where XX is the data line plus 1. (For example, a bad data line 8 would blink as 4–1–1–9.)
- **Initialize VX ASIC** — The boot code detects the processor type and sets up the internal registers of the VX ASIC.
- **Initialize Debug Serial Port** — The boot code checks the validity of the debug serial parameters in NVRAM; if they are valid, it sets the baud rate, data type, and which messages should be sent out the debug port. If the values in NVRAM are not valid, boot code initializes NVRAM to 9600 baud, 8 data bits, one stop, bit, no parity bit, and standard messages.
- **Turn On Instruction Cache** — The instruction cache is turned on to help speed up memory tests and the entire boot process.
- **Enable DRAM Controller** — A DRAM controller is built into the VX ASIC. DRAM must be refreshed a few times to operate correctly. To speed the boot process, the refresh rate is temporarily increased. The message “TESTING HARDWARE PLEASE WAIT” is sent to the LCD, during which time the refreshes run and finish. At this point, the fans start. After sending the message, the refresh rate is set to the proper rate and DRAM is ready to be tested.

- **Test I/O Clock** — The VX ASIC has two clocks for internal timing, a processor clock and an I/O clock. The processor clock cannot be checked because the processor will not run without it, but the I/O clock can be checked. The I/O clock is used for sending data to the operator panel and to get the time for DRAM refreshes. If the boot code detects a problem with the I/O clock, the error blink code 4–3–4 is sent to the diagnostic LED on the CMX board.
- **Read Operator Panel Keys** — The operator panel keys are read to determine if the user is requesting that the printer be placed in download mode, diagnostic mode, or debug SIMM disabled. If **Cancel** and **Start** are pressed during start-up, the printer is placed in download mode. If **Eject/Restore** and **Stop** are pressed during start-up, the printer is placed in diagnostic mode. If any other combination of keys are pressed, the debug SIMM is disabled. Key states are put in an internal register in the VX ASIC.
- **Detect DRAM** — The VX ASIC supports up to four banks of DRAM totalling up to 32 Megabytes. Boot code detects how much DRAM is located in each bank, and relocates the banks to create one contiguous block of DRAM. The size and location of each bank is then displayed on the debug terminal through the debug serial port.
- **Test DRAM** — DRAM is tested by writing a pseudo-random number sequence to all the DRAM, then reading the pattern back to verify it against what was originally written. If an error is detected, the message “ERROR: DRAM AT ADDRESS XXXXXXXX” is displayed on the LCD. When finished, the DRAM test sets all memory to zero.
- **Inform the EC Processor** — The first 8 Kilobytes of DRAM are reserved for the EC processor, which must be notified when DRAM is ready to be used. This is done by putting the message “DCS1” in the ECDC communications register in the VX ASIC.
- **Detect Ethernet Adapter** — An Ethernet adapter it must be detected early in the power up sequence so the printer can tell the adapter it has been detected and continue with its own power up sequence. An Ethernet adapter takes a long time to complete its internal diagnostic tests, so the boot code allows the adapter to power up in parallel with the printer to reduce its effect on overall boot time.
- **Load Boot Messages** — The boot code scans flash memory for OEM boot messages and loads them into DRAM. The manufacturer’s boot code is the same for all OEMs, and contains a set of default messages. Boot messages for specific OEMs are stored in the DC code, not the boot code.

- **Load Boot Code into DRAM** — Flash memory cannot be accessed while flash is being detected, cleared, or programmed. This prevents boot code from running in flash because the opcodes cannot be fetched. This is solved by copying the program into DRAM and executing the program out of DRAM. The boot code is position-independent in order for the program to operate at a different address. The interrupt vector table is also move to DRAM and the vectors are changed to reflect the new address.
- **Detect Flash** — The boot code supports many different kinds of flash memory, permitting any mixture of flash in the four memory banks. The only requirement is that flash must exist in bank 0 and have boot code programmed on it. The boot code displays flash configuration, manufacturer's part number, size, and start address out the debug serial port.
- **Display VX Registers** — The boot code displays the values of the VX registers out of the debug serial port.
- **Check for Pedestal** — Boot code uses the operator panel to determine if the printer is a pedestal or floor cabinet model. Boot code needs to know the difference so the exhaust fan fault can be disabled on a pedestal model. "FAN DISABLED" is printed out at the debug serial port of a pedestal model.
- **Check for Download Mode** — Boot code checks whether the **Cancel** and **Start** keys were pressed at power up. If so, the printer enters download mode. If not, the printer continues the boot routines.
- **Check for Diagnostics Mode** — Boot code checks whether the **Eject/Restore** and **Stop** keys were pressed at power up. If so, the printer enters the Boot Diagnostics menu. If not, the printer continues the boot routines.
- **Check for Remote Download Mode** — Boot code checks if the user remotely requested the printer to enter download mode. If so, the printer enters download mode. If not, the printer continues boot routines.
- **Check for Flash Optimize** — Boot code checks if the user requested the flash file system to be optimized at power up. If so, flash memory is optimized at this time. If not, the printer continues boot routines.
- **Check EC Program** — The EC calculates a checksum of the program stored in its flash memory. If there is problem with its program, the EC puts the message "nopg" in the ECDC communications register. If the boot code detects this message, it displays "ERROR: EC PROGRAM NOT VALID" on the LCD. If the EC processor does not respond within three seconds, the boot code sends "EC STOPPED AT STATE XXXX" to the LCD, where XXXX is one of these states:

State	Description
0000	Power up
0001	Enter checksum calculation
0002	Enter copy download code from FLASH into shared DRAM
0003	Enter programming FLASH mode
0004	Erase EC FLASH
0005	Program FLASH
0006	Finish programming FLASH
0007	Enter initialization of EC serial debug
0008	Enter EC firmware task initializations
0009	Enter power up coil diagnostic
000A	Start running normal EC firmware

- **Check Security PAL and NVRAM** — The chip select for NVRAM comes from the security PAL. If the PAL is not installed, NVRAM cannot be accessed, so the PAL is tested before NVRAM. If the security PAL is not detected, boot codes displays “ERROR: SECURITY PAL NOT DETECTED”. If a security PAL is detected, boot code checks for the presence of NVRAM. If NVRAM is not found, boot code displays “ERROR: NVRAM FAILURE”.
- **Test for Powerup File** — Boot code checks for a DC executable file called powerup.sbr. If found, it executes the file, then returns to boot routines. If the file is not found, boot routines are resumed. If any key was held down during power up, boot code does not look for the powerup file and continues the boot sequence.
- **Automatic EC Update** — Boot code checks whether the automatic EC update feature is enabled by the DC program. If so, it looks for a copy of the EC program in the Flash File System. If it has a copy, it compares the program in EC flash to the program in the Flash File System, and updates the EC program if they are different. If the automatic EC update was not enabled, or if any key was held down during power up, automatic EC update is skipped and the boot sequence continues normally.

- **Debug SIMM** — The debug SIMM contains fast static RAM that automatically replaces the flash memory. Boot code checks for the debug SIMM and, if found, copies the contents of flash memory into the SIMM, then remaps the address of the SIMM to the location of flash. This allows breakpoints and single-stepping from the MTOS debugger. When the debug SIMM is found, boot code displays “DEBUG SIMM ACTIVATED” on the panel and out the debug port.
- **Verify DC Program** — Boot code calculates a checksum at every power up to verify that the program has not been corrupted. If the checksum does not match, boot code displays “ERROR: DC PROGRAM NOT VALID”.
- **Check Security** — The security check verifies that security PAL supports the software that is loaded in flash memory. If the PAL does not support the software, boot code displays “SECURITY CODE VIOLATION”.
- **Check Required DRAM** — Boot code checks whether the amount of DRAM required to run the DC program is larger than the amount of DRAM in the printer. If so, it displays the message “ERROR: PROGRAM NEEDS MORE DRAM”.
- **Tell EC Processor to Finish Booting** — Boot code informs the EC processor that everything is okay and can finish booting up.
- **Diagnostics Passed** — If all tests pass, boot code displays “P05 DIAGNOSTIC TEST PASSED”. At this point, the ribbon motors engage. Boot code then jumps to the start address of the DC software.
- **Display DC Program Information** — Boot code sends the following information out the debug port: the compile time, date, and the address it will jump to to start the DC program.
- **Waiting Ethernet** — If boot code earlier detected an Ethernet adapter, it places the message “WAITING FOR THE ETHERNET ADAPTER” on the LCD so the user will not think the printer has crashed.
- **Jump Back into Flash and Clear DRAM** — Boot code jumps back into flash memory, then clears the DRAM that held the boot code.
- **Jump to MTOS** — Jump to start initialization of the MTOS (Multi-Tasking Operating System).

DC Software Initialization and Power Up

The final part of the power up sequence is initialization and startup of the DC software, which occurs in the following order:

- Clear Uninitialized RAM Variables
- Set Initialized RAM Variables
- Configure RAM (allocated based upon amount in the printer)
- Jump to MTOS (Multi-Tasking Operating System)
- Initialize the Processor (cache, vector table, etc.)
- Partition RAM for Tasks
- Allocate Peripheral Interfaces (console driver, etc.)
- Start Main Task (supervisor)
- Verify and Initialize NVRAM (statistics are cleared if NVRAM is not valid)
- Initialize Libraries (fault, system, emulation)
- Load Front Panel Menus from ROM
- Initialize these tasks, then start them after all have initialized:

    Print Engine Driver Task

    CT Driver Task (sends 8344 code to the CT expansion board)

    Serial Driver Task

    Parallel Driver Task

    CT Emulation Task

    IGP Task (PGL or VGL)

    Base Emulation Task:

        Initialize Fonts
        Initialize Graphics Library
        Complete Emulation Library Initialization
        Wait for all emulation tasks to initialize

    Front Panel Task
- Display “READY” on operator panel

6 Adjustment Procedures

Introduction

The printer is a durable, low-maintenance machine, but some components and systems require occasional adjustment.

Usually, you will be referred to this chapter by a troubleshooting procedure, or as part of a removal/installation procedure.

Preparing the Printer for Maintenance

DANGER:

<3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.

To prepare the printer for maintenance, do the following steps *before* making an adjustment:

1. Power off the printer.
2. Unplug the printer power cord from the AC power source.
3. Disconnect the host data cable from the printer interface.
4. Open the printer cover.
5. Unload paper.
6. Remove the ribbon.
7. Read the entire adjustment procedure before you begin working on the printer.
8. Gather the necessary parts before you begin working on the printer.

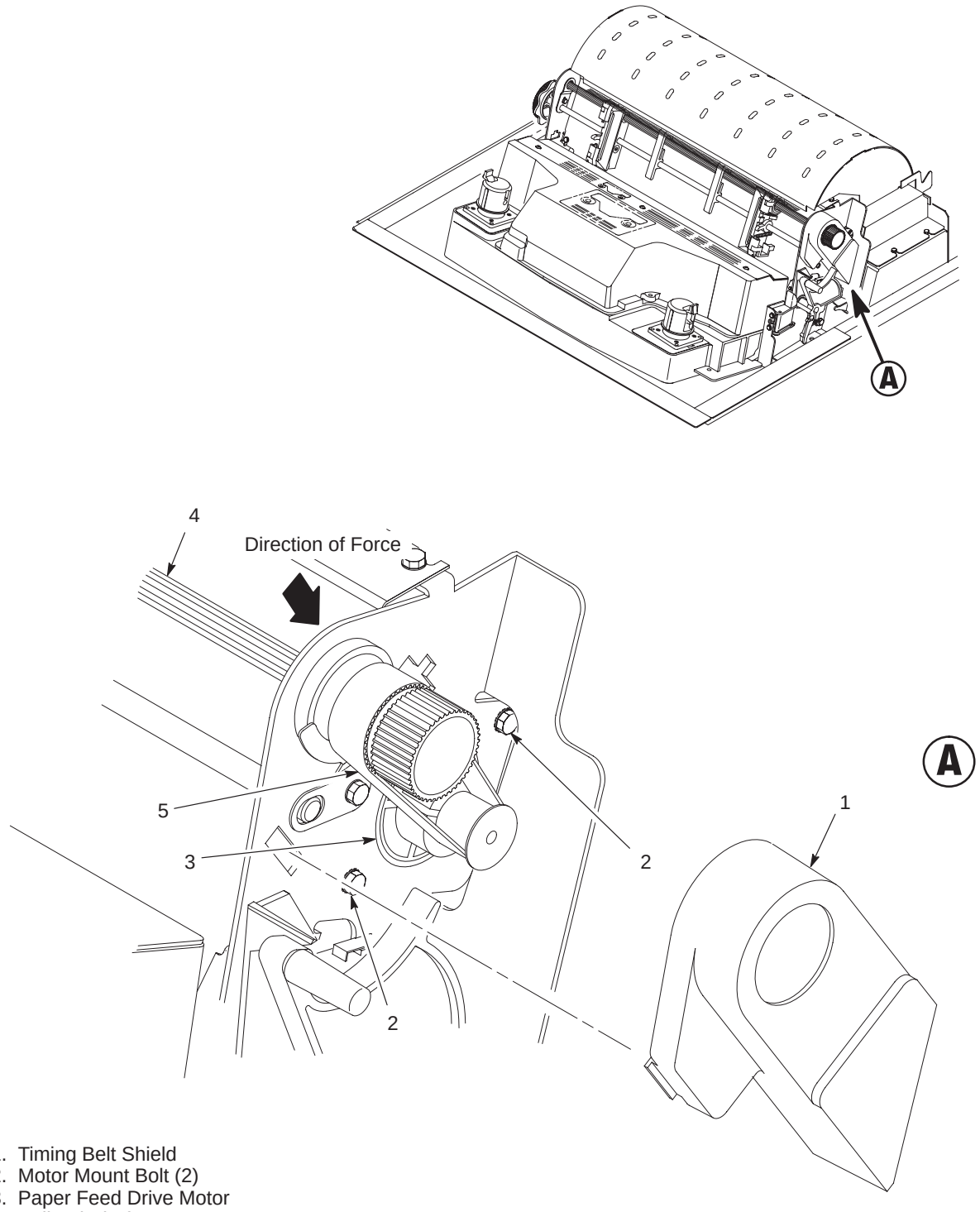
Returning the Printer to Normal Operation

When you are finished servicing the printer, restore it to operation by following these steps:

1. Connect the host data cable to the printer interface.
2. Install the ribbon.
3. Load paper.
4. Plug the AC power cord into the power source.
5. Close the cabinet doors.
6. Power on the printer.
7. Set the top-of-form. (Refer to the *Operator's Guide*.)
8. Select the emulation. (Refer to the *Operator's Guide*.)
9. Test printer operation by selecting and running one of the operator print tests.
10. Close the printer cover.

Belt, Paper Feed Timing, Adjustment (Figure 21)

1. Prepare the printer for maintenance (page 158).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Cabinet Model: Loosen four screws and remove the barrier shield. (See page 269, Figure 43, items 3 and 4.)
   Pedestal Model: Remove the four screws securing the paper guide and barrier shield. Remove the paper guide and barrier shield. (See page 271, Figure 44, items 3, 4, and 5.)
4. Remove the timing belt cover (1) by squeezing the front and back to release the plastic tabs from the slots in the side plate.
5. Loosen (do not remove) the motor mount bolts (2).
6. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor (3) near the mounting base of the motor. Use the splined shaft (4) to steady the gauge.
7. Reduce tension to 12 pounds (53.4 N) and torque the paper feed motor mount bolts (2) to 18 ± 2 inch-pounds (2.03 ± 0.23 N•m).
8. Snap the timing belt cover (1) into the slots in the side plate.
9. Cabinet Model: Install the barrier shield and tighten the four screws. (See page 269, Figure 43, items 3 and 4.)
   Pedestal Model: Install the paper guide and barrier shield and tighten the four screws. (See page 271, Figure 44, items 3, 4, and 5.)
10. Cabinet Model: Install the paper guide assembly (page 235).
    Pedestal Model: Install the top cover assembly (page 210).
11. Return the printer to normal operation (page 159).



1. Timing Belt Shield
2. Motor Mount Bolt (2)
3. Paper Feed Drive Motor
4. Splined Shaft
5. Paper Feed Timing Belt

Figure 21. Paper Feed Timing Belt Adjustment

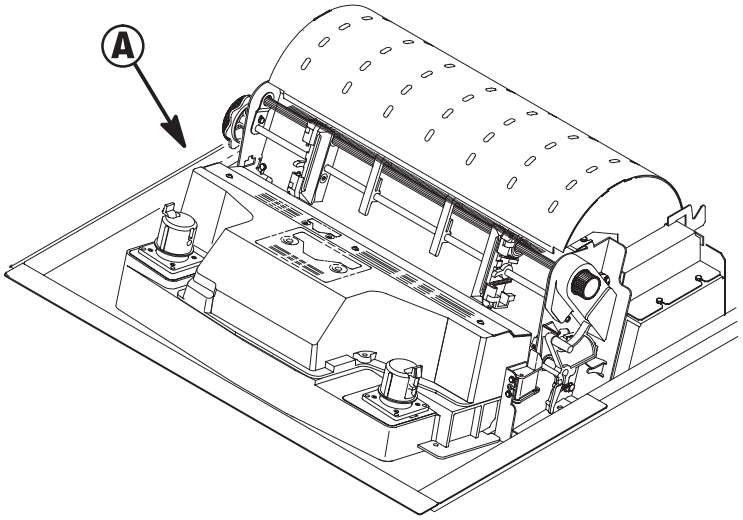
Belt, Platen Open, Adjustment (Figure 22)

1. Prepare the printer for maintenance (page 158).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the motor mount screws (2).
5. Close the forms thickness lever all the way.

ATTENTION

Too much tension on the platen open belt can cause the platen gap to change, which can lead to premature wear of the platen, damaged hammer tips, and poor print quality.

6. Using a force gauge, apply 10 ± 1 pounds (44.48 ± 4.45 N) of tension to the shank of the platen drive pulley (3), pushing away from the large platen pulley.
7. Reduce tension to 5 ± 1 pounds (22.24 ± 4.45 N) and tighten the motor mount screws (2).
8. Snap the platen open belt cover (1) into the slots in the side plate.
9. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).
10. Return the printer to normal operation (page 159).



1. Belt Cover
2. Motor Mount Screw (2)
3. Platen Open Motor Shaft

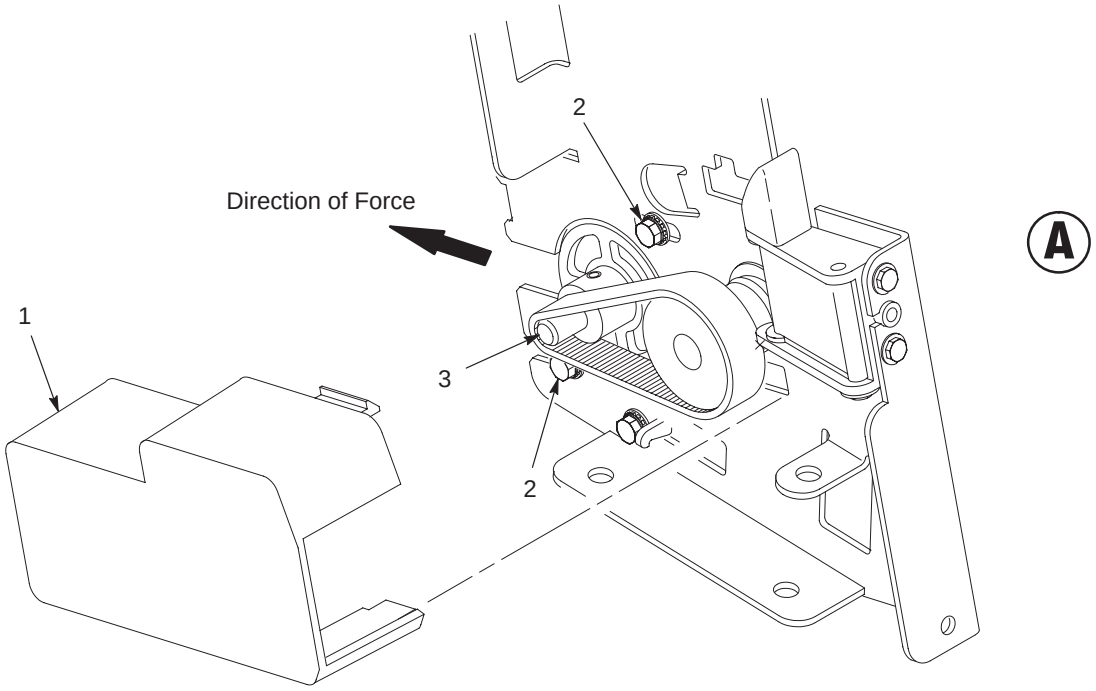


Figure 22. Platen Open Belt Adjustment

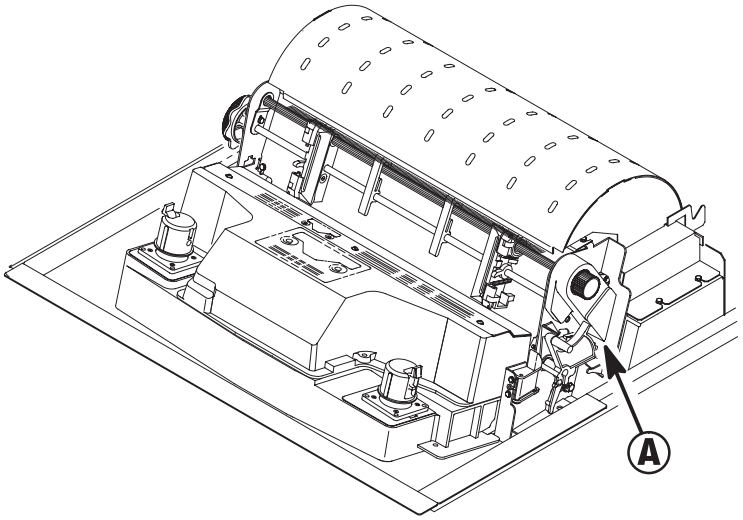
Paper Drive Motor Pulley Alignment (Figure 23)

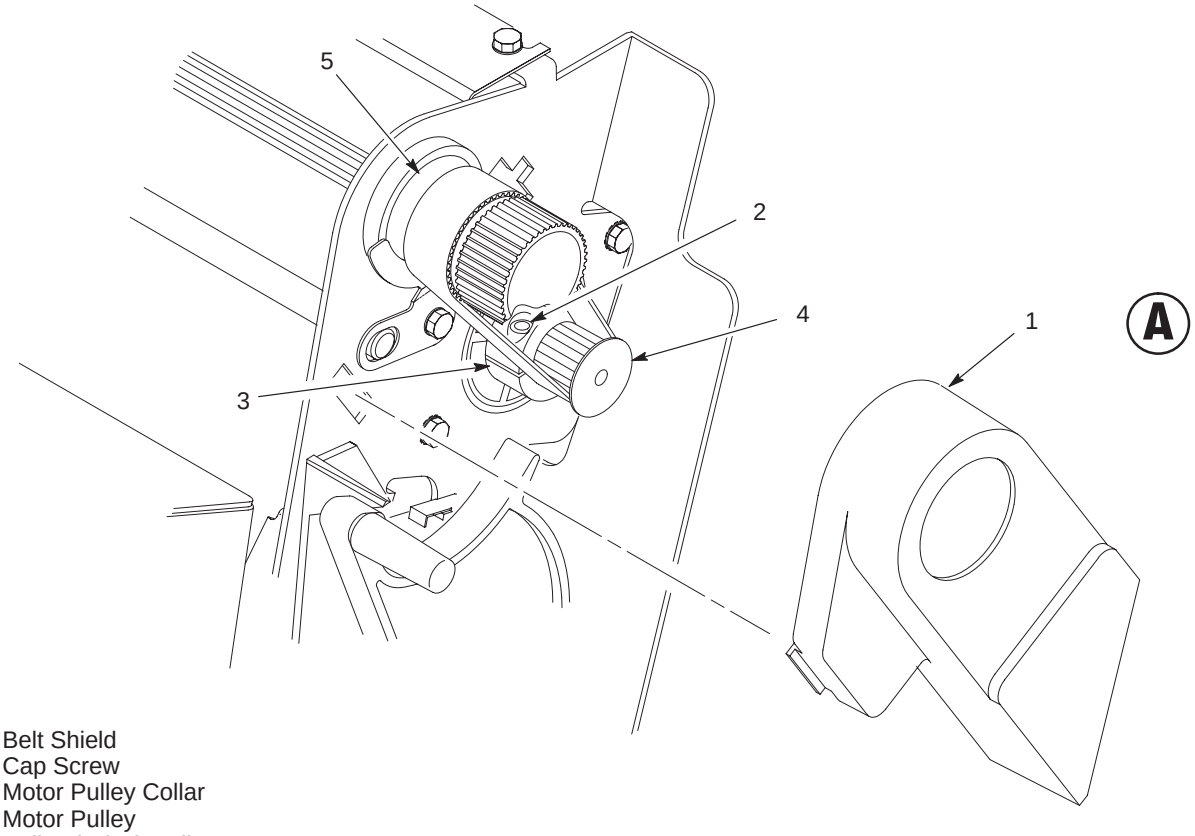
1. Prepare the printer for maintenance (page 158).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Remove the timing belt cover (1) by squeezing the front and back to release the plastic tabs from the slots in the side plate.
4. Loosen the screw (2) in the motor pulley collar (3).
5. Align the paper drive motor pulley (4) with the splined shaft pulley (5).

ATTENTION

Make sure there is at least 0.040 inches (1.016 mm) of clearance between the collar (3) and the motor face plate.

6. Hold the collar (3) flush against the motor pulley (4) and tighten the screw (2).
7. Check for correct tension on the paper feed timing belt (page 160). Adjust if necessary.
8. Snap the timing belt cover (1) into the slots in the side plate.
9. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).
10. Return the printer to normal operation (page 159).



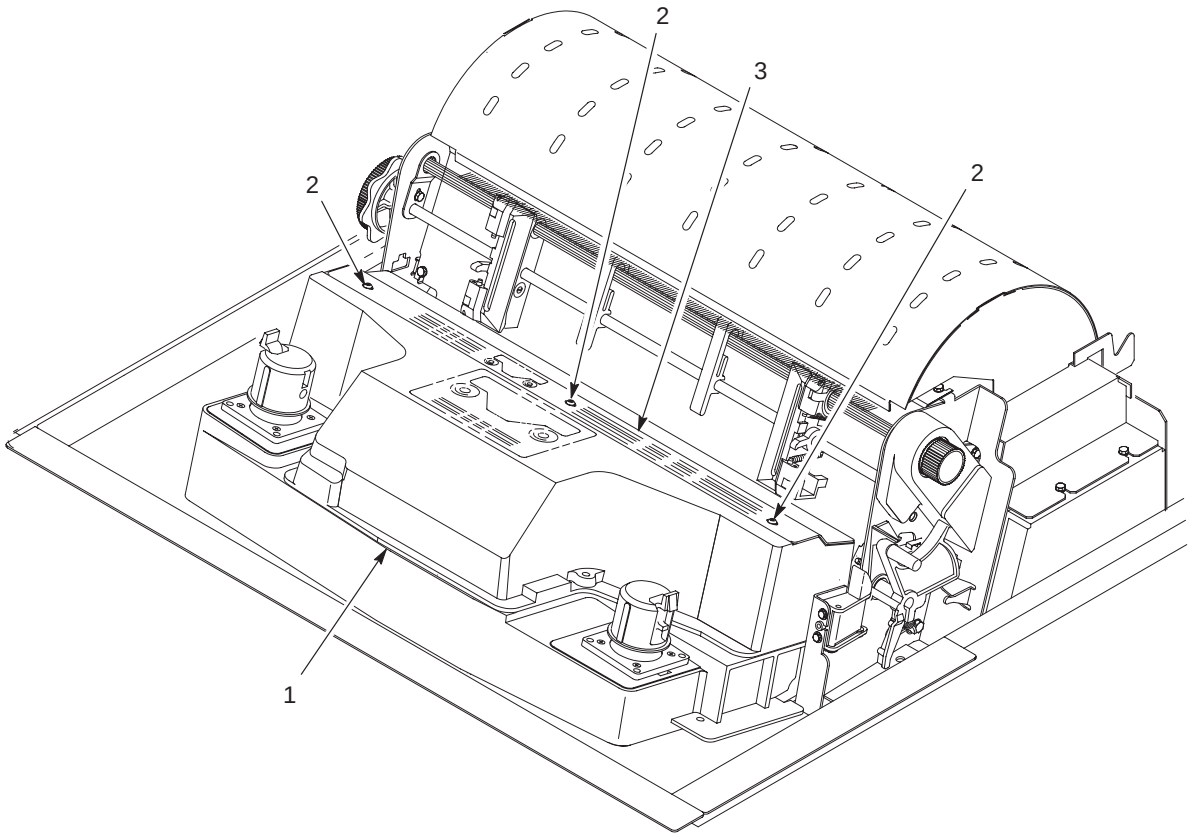


1. Belt Shield
2. Cap Screw
3. Motor Pulley Collar
4. Motor Pulley
5. Splined Shaft Pulley

Figure 23. Paper Drive Motor Pulley Alignment

Paper Scale Alignment (Figure 24)

1. Load paper and ribbon.
2. Connect the power cord to the AC power source.
3. Set the printer power switch to 1 (on).
4. Open the printer cover.
5. Verify that the shuttle cover (1) is properly installed (page 209).
6. Print a full 136 column line by selecting and running one of the diagnostic self-tests. (See Chapter 4.)
7. Check alignment of the scale to the print at column positions 1 and 136.
8. If adjustment is necessary, loosen the three button-head 5/64 inch hex screws (2).
9. Position the scale (3) so that column positions 1 and 136 line up with the first and last characters on the 136 character printout.
10. Tighten the 5/64 inch button-head screws (2).
11. Close the printer cover.



1. Shuttle Cover
2. Screw, Button-Head, 5/64 inch hex (3)
3. Paper Scale

Figure 24. Paper Scale Alignment

Platen Gap Adjustment (Figure 25)

IMPORTANT

Only do this procedure if the original equipment shuttle frame assembly or platen has been replaced by a new or refurbished unit.

1. Prepare the printer for maintenance (page 158).
2. Remove the shuttle cover assembly (page 209).
3. Loosen the platen open belt (page 162, steps 2, 3, and 4).
4. Raise the forms thickness lever (1) to the fully open position.

ATTENTION

Do not force the platen against the feeler gauge. Damage to the hammer tips will result.

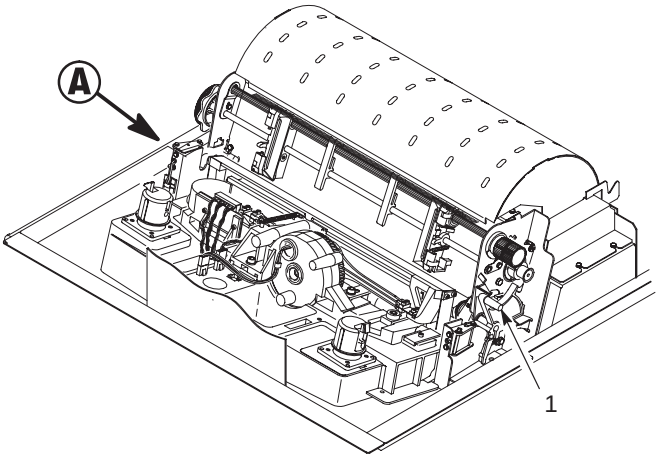
5. Insert a 0.011 inch (0.28 mm) flat feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), within four hammer positions of the left end of the hammer bank.

ATTENTION

Adjust the platen set screws less than 1/4 turn on one side, then check the other side. Adjustment sensitivity is approximately 0.03 inch per revolution of the set screw. Also, insert the feeler gauge no more than 2 inches down from the top of the ribbon mask.

6. Gently close the forms thickness lever (1). As the platen is closing, gently slide the feeler gauge up and down, keeping it between the hammer tip and ribbon mask. If the feel is too tight when the platen is being closed, adjust the 3/32 inch set screw (5) at the end of the platen counterclockwise. If the feel is too loose, adjust the set screw clockwise. With the forms thickness lever closed all the way, the feeler gauge should contact both the tips and the ribbon mask and move with light friction. Shift the gauge slightly to verify.
7. Repeat steps 4 through 6 at the right end of the hammer bank.
8. After adjusting both sides, check the gap again at both ends. Readjust if necessary.
9. When the platen gap is correct at both ends of the platen, adjust the platen open belt (page 162).

10. Install the shuttle cover assembly (page 209).
11. Check the hammer phasing adjustment (page 179).
12. Return the printer to normal operation (page 159).



1. Forms Thickness Lever
2. Feeler Gauge (0.011 inch or 0.28 mm)
3. Hammer Bank Cover Plate
4. Ribbon Mask
5. Set Screw, 3/32 inch hex (2)

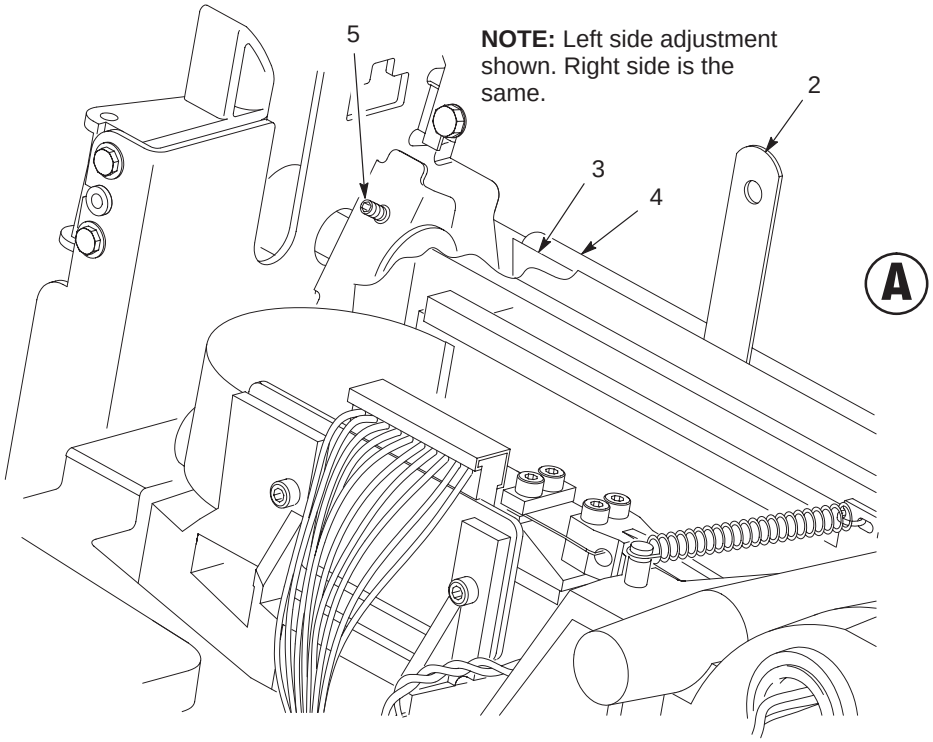
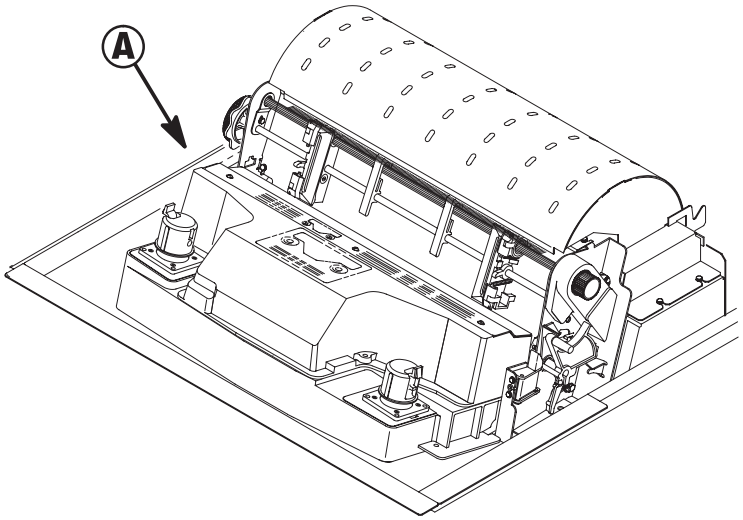


Figure 25. Platen Gap Adjustment

Platen Open Motor Pulley Alignment (Figure 26)

1. Prepare the printer for maintenance (page 158).
2. Cabinet Model: Go to step 3.
   Pedestal Model: Remove the top cover assembly (page 210).
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the 1/16 inch set screw (2) in the motor pulley.
5. Bottom out the platen open motor pulley (3) on the motor shaft and torque the 1/16 inch set screw (2) to 9 ± 2 inch-pounds (1.02 ± 0.23 N•m).
6. Check the platen open belt tension (page 162). Adjust if necessary.
7. Snap the platen open belt cover (1) into the slots in the side plate.
8. Cabinet Model: Go to step 9.
   Pedestal Model: Install the top cover assembly (page 210).
9. Return the printer to normal operation (page 159).



1. Belt Cover
2. Set Screw
3. Platen Open Motor Pulley
4. Platen Shaft Pulley

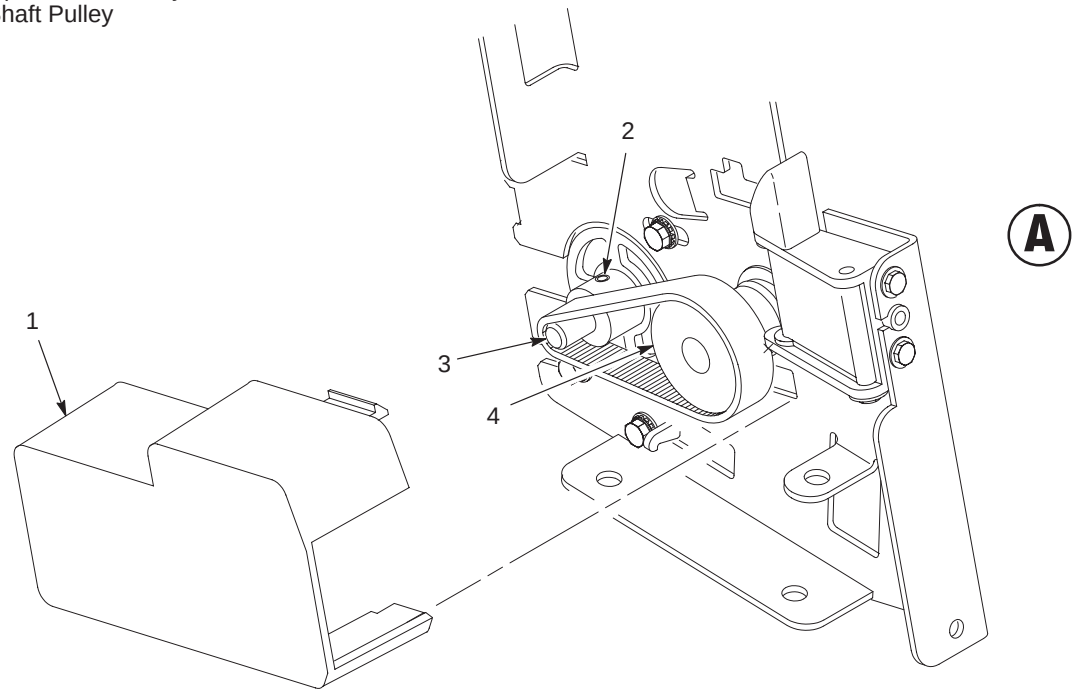
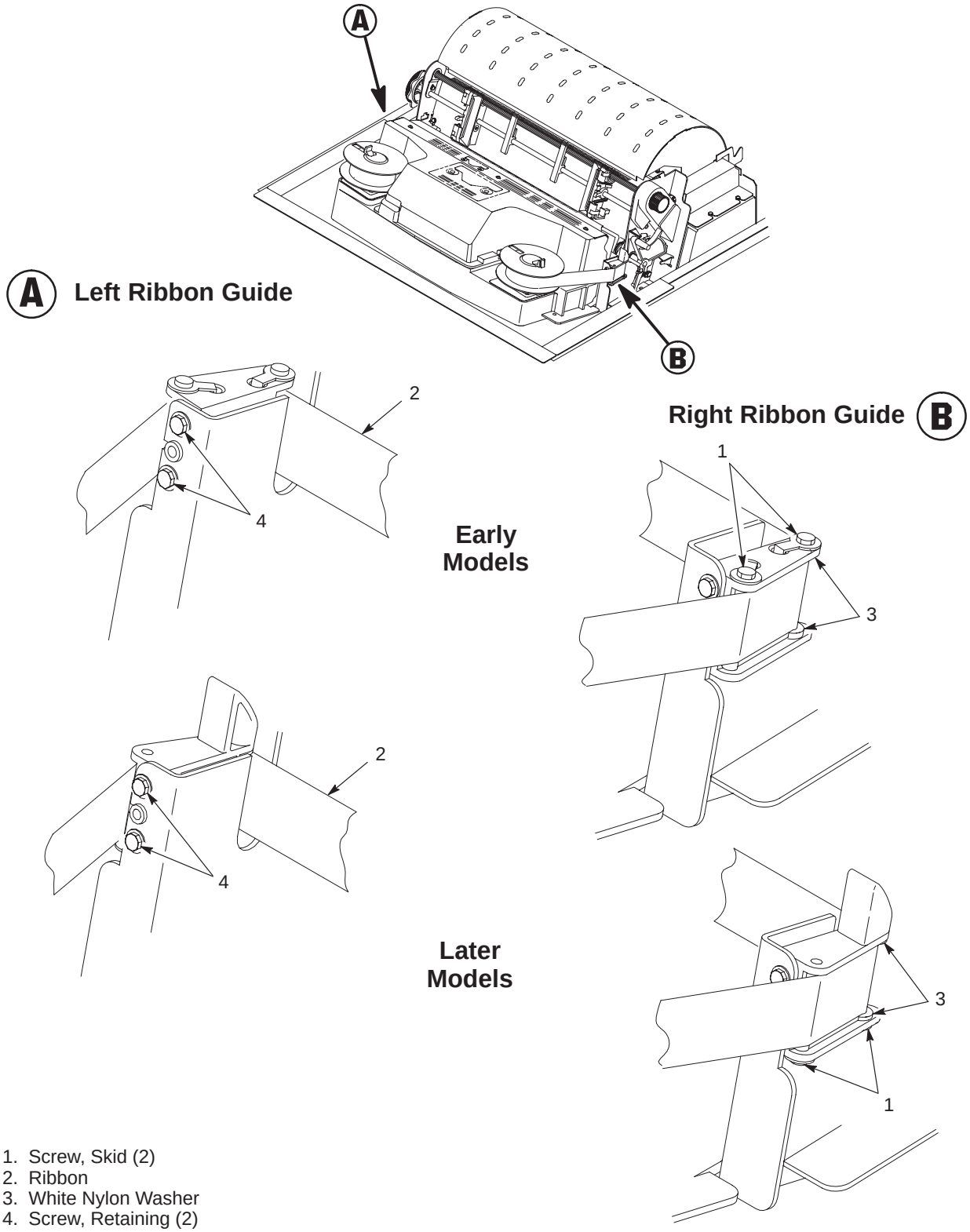


Figure 26. Platen Open Motor Pulley Alignment

Ribbon Guide Alignment (Figure 27)

1. Open the printer cover.
2. Load paper and install the ribbon. To align a ribbon guide, wind the ribbon fully onto the ribbon spool on the opposite side. For example, to align the left ribbon guide, wind the ribbon until the right ribbon spool is full.
3. Check ribbon tracking by running the PRINTER MECHANISM TESTS : Shuttle Slow (page 138).
4. On the ribbon quide to be adjusted, momentarily short between the ribbon guide skid screws (1) to verify that the ribbon reverses.
5. Observe how the ribbon (2) passes around and across the ribbon guide. It should be centered and not folding against either of the two white nylon washers (3).
6. If the ribbon is not centered, loosen the retaining screws (4) just enough so that you can rotate the ribbon guide to new positions, but it remains in place once moved.
7. Rotate the ribbon guide as required to center the ribbon (2).
8. Observe how the ribbon (2) winds onto the ribbon spool of the side you adjusted. If the ribbon is interfering with the flange of the spool, make sure the ribbon hub and spool are mounted correctly.
9. Tighten the retaining screws (4).
10. Allow most of the ribbon to wind onto the ribbon spool on the side you adjusted, then repeat steps 3 through 9 for the other ribbon guide.



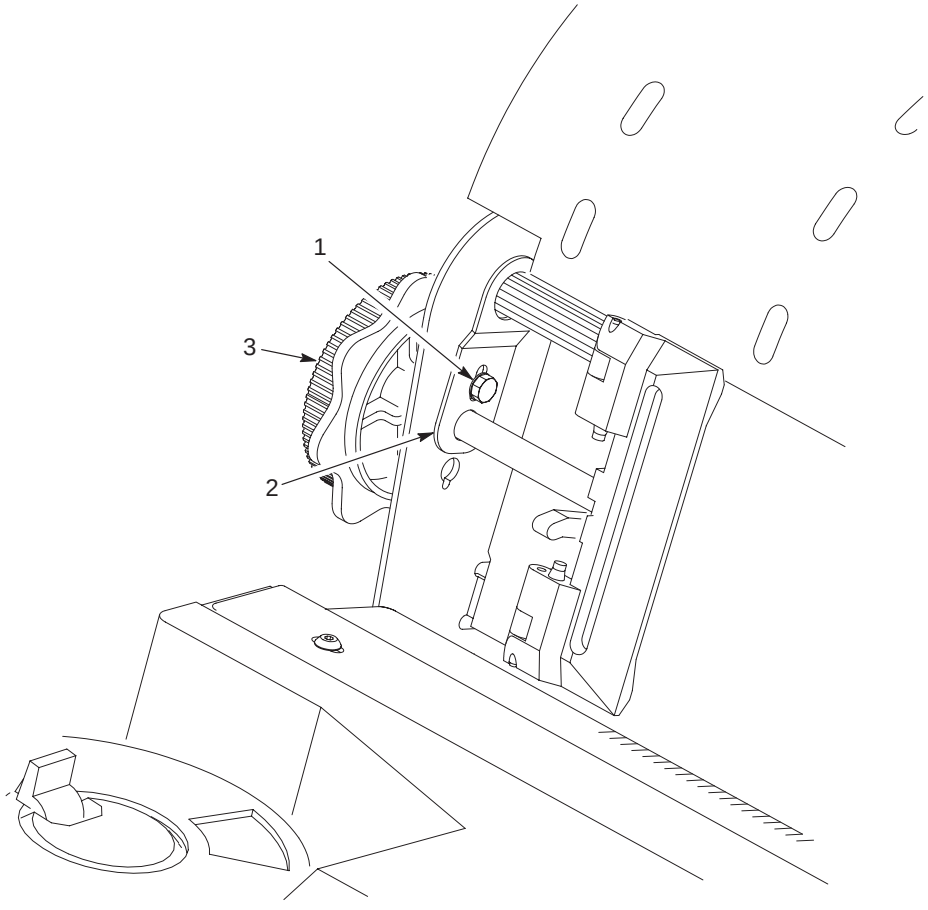
1. Screw, Skid (2)
2. Ribbon
3. White Nylon Washer
4. Screw, Retaining (2)

Figure 27. Ribbon Guide Alignment

Splined Shaft Skew Adjustment (Figure 28)

If lines of print are not parallel with the edge perforations on the paper, perform the following adjustment.

1. Open the printer cover.
2. Loosen the screw (1) securing the adjusting link (2).
3. Adjust the link (2) by raising or lowering the horizontal adjustment knob (3) to obtain print parallel with paper perforations. Tighten the screw (1).
4. Return the printer to normal operation (page 159).



1. Screw
2. Adjusting Link
3. Horizontal Adjustment Knob

Figure 28. Splined Shaft Skew Adjustment

Adjusting the End of Forms Distance

This procedure tests and sets the distance from the page perforation at which an END OF FORMS fault message is triggered. This adjustment prevents printing on the platen when the printer runs out of paper. The measurement units are dot rows.

You will use the dot row patterns printed by the END OF FORMS ADJUST self-test to verify that this parameter is set correctly.

NOTE: Do this procedure only if a new paper detector switch assembly has been installed, or if you are sure that the end of forms adjustment is incorrect. An END OF FORMS triggering distance of 1 or 2 dot rows from the perforation is acceptable; 5 to 7 dot rows off indicates adjustment is required.

Also, although it is not required, it is advisable to test the End of Forms distance with 6-part paper, in order to verify correct printing with multi-part forms.

The procedure below describes how to run the END OF FORMS ADJUST printer test and modify the END OF FORMS ADJUSTMENT VALUE.

1. Power on the printer.
2. Load paper and set the top of form. Make sure the forms thickness lever is closed. Open the cabinet front door.
3. On the sheet of paper just below the paper entrance slot, tear a four-inch square on the left side, immediately below the perforation. (See Figure 29.) This creates a hole that will trigger an END OF FORMS condition, but allows printing to the right of the hole (which would normally be on the platen).
4. Tear a four inch square in the manner described above, on every third sheet, until you have made 3 or 4 holes.
5. If the printer is in READY mode, press **Stop** to put it into NOT READY mode.
6. Press **Scroll↑ + Scroll↓** to unlock the **Enter** key.
7. Press **Scroll↑ + Scroll↓ + Return + Enter** to enter the CE Tests menu. (Press all four keys at the same time.)

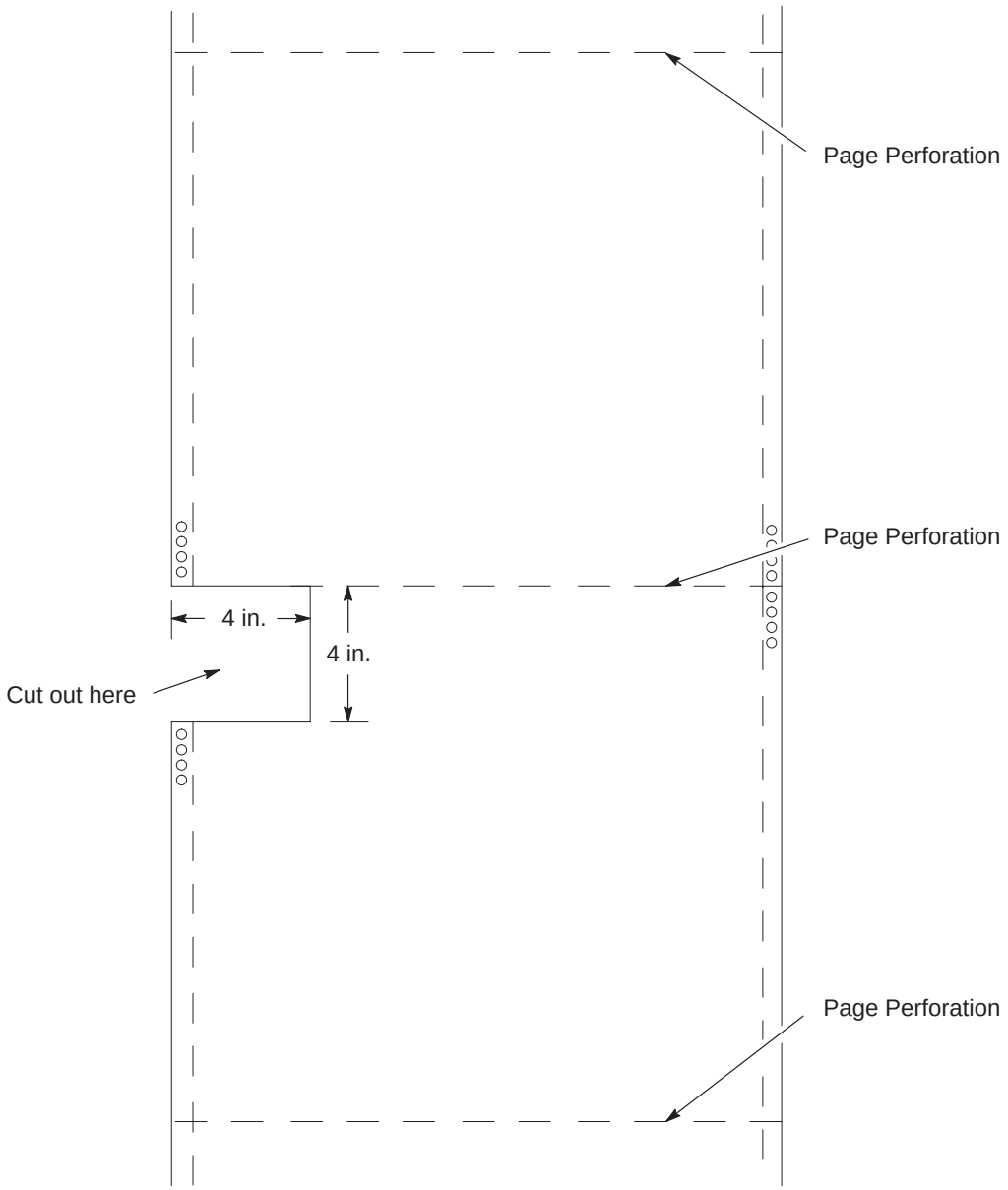
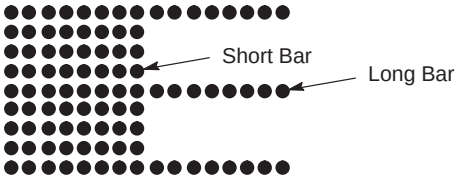


Figure 29. Paper Preparation for Paper Out Adjustment Test

8. The display will show “SERVICE / PRINTER MECHANISM TESTS”, the first menu item. Press **Enter** to enter the mechanism tests menu.

9. Press **Scroll**↑ or **Scroll**↓ until
“PRINTER MECHANISM TESTS / END OF FORMS ADJUST” is on the display.

   This test will print a vertical “comb” pattern at around column 70, each long bar separated by three shorter bars. An enlarged example of the comb pattern is shown below.



10. Press **Enter** until the END OF FORMS ADJUST test starts.
The comb pattern will print until the display shows
“001 END OF FORMS / LOAD FORMS” and (if enabled) the audible alarm sounds. If the alarm sounds, press **Stop** to silence it.

11. Remove the paper from the tractors and examine the area of the page perforation. (If the alarm sounds when you open the platen, press **Stop** to silence it.)

    If a bar from the comb pattern just meets the perforation, the end of forms adjustment distance is correct. (A bar exactly on perforation is ideal; 1 or 2 dot rows off is OK; 5 to 7 dot rows off is too much.) Unless you wish to restart the procedure with 6-part paper, you may stop the test here, and skip to step 22. (See the note at the beginning of this procedure.)

    If the comb pattern stopped short of the perforation or printed beyond the perforation, go to step 12.

12. Measure how short or long the comb pattern printed by counting the number of dot rows needed to reach the perforation, or the number of dot rows that printed beyond the perforation.

NOTE: You can use the long bars to count the dot rows quickly. There are three dot rows between each long bar, so each long bar increases the number of dot rows by four. You can also tear off a small piece of the comb pattern from the beginning of the pattern and use it as a ruler to help you measure the dot rows required either to reach the perforation or back up to it.

13. Reload the paper and set the top of form.

14. Press **Scroll↑ + Scroll↓ + Return + Enter** to enter the CE Tests menu. (Press all four keys at the same time.)

15. The display will show “SERVICE / PRINTER MECHANISM TESTS,” the first menu item. Press **Scroll↑** or **Scroll↓** until “SERVICE / END OF FORMS ADJUSTMENT VALUE” is on the display.

16. Press **Enter.** The top line of the display will show “END OF FORMS ADJUSTMENT VALUE” and the bottom line will show the current setting for the number of dots.

17. Press **Enter.** The number of dots will move up to the top line of the display.

18. Using the **Scroll↑** or **Scroll↓** key, adjust the *XX* DOTS value up or down by the number of dots you counted in step 12. (If the comb pattern stopped short of the perforation, increase the number of dots. If the comb pattern printed beyond the perforation, decrease the number of dots.)

19. Press **Enter** to select the new number of dots as the active value. (The asterisk that appears tells you that it is now the active value.)

20. Press **Stop** to put the printer into NOT READY mode.

21. Run the END OF FORMS ADJUST and the END OF FORMS ADJUSTMENT VALUE tests until the comb pattern prints at an acceptable distance from the page perforation. (Return to step 7.)

22. When the End of Forms Adjustment is acceptable, reload the paper, feed it past any remaining unused holes that you tore in it, and set the top of form.

23. Press **Scroll↑ + Scroll↓** to lock the **Enter** key.

24. Press **Start** to put the printer into READY mode.

Hammer Phasing Adjustment

You must check and adjust hammer phasing if the CMX controller board is replaced, the shuttle frame assembly is removed, or if the MPU is replaced.

The hammer phase value is a timing parameter that permits you to adjust the horizontal alignment of dots in character printing. The phase value numerical units are relative; they do not represent a physical measurement or value. Thus there is no “correct” value or range. But, if the phasing value is far enough from the theoretical ideal value on a particular printer, errors can occur. If, for example, you are adjusting phasing and an error such as 124 PAPER FIFO UNDERFLOW occurs, the phase value may be too high. Try a lower value.

The factory prints the initial phase value on the aluminum casting of the shuttle assembly, next to the motor housing. Adjust the phasing to this value and recheck the horizontal alignment. When alignment is acceptable, write the new phasing value on the shuttle.

Phasing should be adjusted with the printer printing at full paper width.

IMPORTANT

The printer must be printing the Phase pattern of “H’s” when the Phasing Value is changed, or the New Phasing Value will not be written into NVRAM. If the value is changed when not printing, the printer will return to its default phasing value when powered off then back on.

1. Power on the printer.
2. Install the ribbon.
3. Load full width (136 column) paper and set the top of form.
4. Press **Stop** to put the printer into NOT READY mode.
5. Press **Scroll↑ + Scroll↓** to unlock the **Enter** key.
6. Press **Scroll↑ + Scroll↓ + Return + Enter** to enter the CE Tests menu. (Press all four keys at the same time.)
7. The display will show “SERVICE / PRINTER MECHANISM TESTS”, the first menu item. Press **Enter** to enter the mechanism tests menu.
8. Press **Scroll↑** or **Scroll↓** until “PRINTER MECHANISM TESTS / HAMMER PHASING” is on the display.

9. Press **Enter**. The printer begins printing all Hs, each line preceded by the phasing index number.

10. Press **Return.** The display will show "SERVICE / PRINTER MECHANISM TESTS".

11. Press **Scroll**↑ or **Scroll**↑ until "SERVICE / HAMMER PHASE VALUE" is on the display.

12. Press **Enter**. The top line of the display will show "HAMMER PHASE VALUE" and the bottom line will show the current phasing index number.

13. Press **Enter.** The phasing index (followed by an asterisk) will move up to the top line of the display.

14. Press **Scroll**↑ or **Scroll**↑ to increase or decrease the phasing index, then press **Enter** to activate the value as it prints. Continue to increase or decrease the phasing index until the pattern of Hs appears as shown below:

Needs Adjustment | **Correct** | Needs Adjustment

15. When the print pattern is acceptable, press **Stop**. Printing stops, and the printer automatically enters the current phase index value into NVRAM. The display shows "NOT READY".

16. Press **Scroll**↑ **+ Scroll**↑ to lock the **Enter** key.

17. Close the printer cover. Press **Start** to put the printer into READY mode.

NOTE: If you changed the phasing value, power down the printer, remove the shuttle cover, and write the new phase value on the aluminum shuttle casting.

Loading Flash Memory

Emulation and operating system software are loaded into flash memory at the factory, but you will install software in the following situations:

- The customer needs to upgrade printer software
- The customer needs different emulation software
- You have replaced the controller board
- You have added or replaced a flash memory SIMM

Emulation and operating system software are stored as a compressed file. The file is “executable;” you will expand it and copy it into printer flash memory with a single command.

DANGER:

<4>	**Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.**
<5>	**Power off the printer and disconnect the power cord before connecting or disconnecting communication port, teleport, or attachment cable connector.**

1. Make a printout of *all* saved configurations. (Refer to the *Setup Guide*.) (Installing new software erases all saved configurations. You will use the printouts to restore printer configuration.)
2. Set the printer power switch to O (off).
3. Unplug the AC power cord from the printer.
4. If the printer’s parallel data cable is connected to the parallel port of an IBM or IBM-compatible computer using the PC-DOS* or MS-DOS** operating system, skip to step 8. If not, go to step 5.
5. Disconnect all data input cables from the printer interface. If the printer has an internal Ethernet interface card, do the following:
   a. Cabinet models: remove the paper guide assembly (page 235). Pedestal models: remove the top cover assembly (page 210).
   b. Unplug the Centronics I/O cable from the Ethernet interface card.

c. Secure the loose end of the Centronics I/O cable to prevent the connector from contacting any other exposed components.

d. Attach the parallel cable connector from the computer to the Centronics I/O connector.

6. Connect the parallel data cable to the default parallel port (LPT1) of an IBM or IBM-compatible personal computer using the PC-DOS or MS-DOS operating system.

NOTE: You can connect the data cable to the LPT2 port if the LPT1 port is already in use. You can also download software through the printer serial port. The download commands are different if you use these ports, as described in the note after step 19.

7. Connect the parallel data cable to the parallel port of the printer.

8. Plug the AC power cord into the printer.

9. Power on the personal computer.

10. Insert the emulation or upgrade diskette into diskette drive A (or B) of the personal computer.

11. Make the diskette drive the active drive by typing the following at the DOS prompt:
A:<return>
(If the diskette is in drive B, type **B:**<return>)

12. Get the name of the compressed file on the diskette by listing the contents of the diskette; at the DOS prompt type:
DIR<return>
The compressed file on the diskette takes the form *FILENAME.EXE*
Write down the complete name of the file with the *.EXE* extension.

13. On the printer control panel, press and hold down the **Start + Cancel** keys. Without releasing the keys, power the printer on. Continue holding the **Start** and **Cancel** keys down.

14. When you see “WAITING FOR PROGRAM DOWNLOAD” on the LCD, release the **Start** and **Cancel** keys.

NOTE: The port default is CENTRONICS; this is the standard download through the parallel port. If you want to use the default, continue at step 19.

15. Press the **Scroll↑** key; “SELECT DOWNLOAD PORT=DATAPRODUCT” appears on the LCD.

16. Press **Scroll↑** again to cycle through the download ports available in the printer:

DATAPRODUCT	(parallel)
CENTRONICS*	(parallel) (default port)
RS232–9600	(RS-232 serial, 9600 baud)
RS232–19.2K	(RS-232 serial, 19200 baud)
RS232–38.4K	(RS-232 serial, 38400 baud)
RS232–115K	(RS-232 serial, 115000 baud)
RS422–9600	(RS-422 serial, 9600 baud)
RS422–19.2K	(RS-422 serial, 19200 baud)
RS422–38.4K	(RS-422 serial, 38400 baud)
RS422–115K	(RS-422 serial, 115000 baud)

17. Press **Scroll↑ + Scroll↑** to unlock the **Enter** key.

18. When the printer download port you want to use is displayed on the LCD, press **ENTER**. “WAITING DOWNLOAD / PORT = <*your selection*>” appears on the display.

19. At the DOS prompt on the computer type:
    `FILENAME.EXE –pb`<return>
    where `FILENAME.EXE` is the file you noted in step 12.
    This command expands the file and copies it as a binary file into the flash memory on the CMX controller board.

NOTE: If you are downloading the file using the LPT2 port on the PC, enter the following DOS command:
`FILENAME.EXE –pb 2` <Return>

If you are downloading the file into the printer serial port, enter the following DOS commands:
`MODE COM1:9600,N,8,1,P`<Return>
`FILENAME.EXE –PBC1`<Return>

20. While the file is copied into memory, the printer LCD informs you of the load process and status. (See Table 5.)

21. When the file has successfully loaded into memory and the printer has reset itself, set the printer power switch to O (off).

22. Unplug the AC power cord from the printer.

23. Remove the diskette from the personal computer and store it with the printer.

24. Power off the personal computer.

25. If you had to install a parallel data cable to the computer and printer in step 6, disconnect it from the computer and printer.

26. Reconnect the customer's data input cable(s) to the printer, if required.

27. Return the printer to normal operation (page 159).

28. Using the configuration printout(s) you made in step 1, reconfigure the printer. (Refer to the *Setup Guide*.)

Table 5. Flash Memory Message Guide

NOTE: A continuous IML cycle indicates coax/twinax code is being loaded into a printer with a missing, defective, or improperly installed Coax/Twinax board. If the printer is supposed to have this feature, reseat the Coax/Twinax board. If the printer is not supposed to have this feature, install new emulation code without the Coax/Twinax feature.

Message	Explanation	Required Action
CLEARING PROGRAM FROM FLASH	The program successfully loaded into printer RAM and the checksum matched. The old program is now being deleted from flash memory.	None
DIAGNOSTIC PASSED	The printer passed its memory and hardware initialization tests.	None
ERROR: DC PROGRAM NOT VALID	Printer cannot find the data controller program or the validation checksum is corrupted.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: DRAM AT ADDRESS XXXXXXXX	The printer found a defective memory location.	Replace the DRAM.

Message	Explanation	Required Action
ERROR: EC PROGRAM NOT VALID	Printer cannot find the engine controller program or the validation checksum is corrupt.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: EC STOPPED AT STATE XXXX	Hardware fault in the engine controller.	Replace the CMX controller board.
ERROR: FLASH DID NOT PROGRAM	The printer encountered an error trying to program flash memory.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: FLASH NOT DETECTED	The printer could not find any flash memory.	Install flash memory before attempting to download this program.
ERROR: NO DRAM DETECTED	The printer could not find any DRAM.	Check DRAM on CMX. If present, reseat DRAM, If missing, install DRAM.
ERROR: NVRAM FAILURE	The non-volatile memory has failed.	Replace the CMX controller board. (Do NOT attempt to replace NVRAM.)
ERROR: PROGRAM NEEDS MORE DRAM	The printer requires more DRAM memory in order to run the downloaded program.	Add DRAM or use a smaller emulation program.
ERROR: PROGRAM NEEDS MORE FLASH	The printer requires more flash memory in order to run the downloaded program.	Add flash memory or use a smaller emulation program.

Message	Explanation	Required Action
ERROR: PROGRAM NOT COMPATIBLE	The printer is not compatible with the downloaded program. User tried to load CMX-compatible diskette in CBO-controlled printer, or vice versa.	Use the correct emulation software option(s) for this model. If the printer is an IBM 6404–B01, the controller is a CBO board. If the printer is an IBM 6400, the controller is a CMX board.
ERROR: PROGRAM NOT VALID	The printer does not see a program in flash memory.	There is no program in printer memory. Go to step 2.
ERROR: SECURITY PAL NOT DETECTED	The security PAL is not present or has failed.	Check the security PAL at location U54 on the CMX controller. If the PAL is absent, install the correct PAL. If security PAL is present, replace the CMX controller board.
ERROR: SHORT AT ADDRESS XXXX	Hardware failure in DRAM or CMX controller circuitry.	Replace DRAM. If message occurs with new DRAM, replace CMX controller board.
ERROR: WRITING TO FLASH	Hardware or software fault in flash memory.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: WRONG CHECKSUM	The printer received the complete program but the checksum did not match. The data were corrupted during download.	Download the program again: Power off the printer and start over at step 13.
LOADING PROGRAM FROM PORT XX%	The new program is loading into printer RAM. XX indicates how much of the program has loaded.	None

Message	Explanation	Required Action
LOADING PROGRAM INTO FLASH	The printer has deleted the previous program from flash memory and is loading the new program into flash memory.	None
RESETTING . . . PLEASE WAIT	The printer finished loading the program into flash memory and is automatically resetting itself.	None
RESTORING BOOT CODE	Normal download initialization message.	None
SECURITY CODE VIOLATION	The software running or being downloaded does not match the security PAL code.	Install the correct PAL or program. (PAL and program must match.)
SENDING PROGRAM TO EC PROCESSOR	The printer is loading the engine controller program into the engine controller.	None
TABLE MISMATCH DOWNLOAD AGAIN	EC software update in process.	Download the program again: Power off the printer and start over at step 13.

Coil Temperature Adjustment

IMPORTANT

This procedure applies only to models 6400–014 and 6400–015. Do this procedure only when the original CMX controller board or shuttle frame assembly have been replaced. Do not do this procedure if the original CMX board or shuttle frame assembly were removed and reinstalled as part of other maintenance tasks.

The shuttle frame assembly must be at room temperature to do this procedure.

1. Raise the printer cover.
2. Power on the printer.
3. If the **Ready** indicator is on, press the **Stop** key. The printer must be in the NOT READY state to do this procedure.
4. Press **Scroll↑ + Scroll↓ + Return + Enter**. (Press all four keys at the same time.) “SERVICE / PRINTER MECHANISM TESTS” appears on the display.
5. Press **Scroll↑ + Scroll↓** to unlock the **Enter** key.
6. Press the **Scroll↑** or **Scroll↓** key until “SERVICE / SET COIL TEMPERATURE” appears on the display.
7. Press **Enter**. The display tells you to “PLEASE WAIT” while the coil temperature is set by an automatic calibration sequence in printer software.
8. When the display again reads “SERVICE / SET COIL TEMPERATURE” press **Scroll↑ + Scroll↓** to lock the **Enter** key.
9. Press **Stop** to exit the menu and put the printer in the NOT READY state.

—OR—

10. Press **Start** to exit the menu and put the printer in the READY state.
11. Coil temperature is now set. Power off the printer and close the printer cover.

Set Shuttle Speed

IMPORTANT

This procedure applies only to models 6400–004, –04P, –005, and –05P. Do this procedure only when the original CMX controller board or shuttle frame assembly have been replaced. Do not do this procedure if the original CMX board or shuttle frame assembly were removed and reinstalled as part of other maintenance tasks.

1. Power on the printer and raise the printer cover.
2. If the **Ready** indicator is on, press the **Stop** key. The printer must be in the NOT READY state to do this procedure.
3. Press **Scroll↑ + Scroll↓ + Return + Enter**. (Press all four keys at the same time.) “SERVICE / PRINTER MECHANISM TESTS” appears on the display.
4. Press **Scroll↑ + Scroll↓** to unlock the **Enter** key.
5. Press the **Scroll↑** or **Scroll↓** key until “SERVICE / SHUTTLE SPEED” appears on the display.
6. Press **Enter**. “SHUTTLE SPEED / 475* ” or “SHUTTLE SPEED / 500* ” appears on the display. The asterisk [*] indicates which shuttle speed is currently active.
7. Press **Scroll↑** until the shuttle speed you want appears on the display.
8. Press the **Enter**. An asterisk [*] appears next to the selection, indicating it is now the active shuttle speed.
9. Press **Scroll↑ + Scroll↓** to lock the **Enter** key.
10. Press **Stop** to exit the menu and put the printer in the NOT READY state.
11. Power off the printer, then power on the printer to activate the new shuttle speed value.
12. Install the ribbon and load full-width paper.
13. Select and run the Ripple Print printer test (page 135).
14. Examine the printout: if gaps or dark bars appear in the printout, go back to step 2 and set the shuttle speed to the other option.
15. When the printout is acceptable, power off the printer and close the printer cover.

7 Replacement Procedures and Illustrated Parts List

Organization of This Chapter

IMPORTANT

The components specified in this chapter are field replaceable units (FRUs). FRUs must be repaired at the factory. Do not attempt field repair of these items.

This chapter is divided into two sections.

- **Section I: Replacement Procedures**

  This section contains written procedures for removing and installing components that are replaceable at the field service level of maintenance. The procedures in this section refer you to the illustrations in Section II.

  Section I begins on page 192.

- **Section II: Illustrated Parts List**

  This section contains drawings of all assemblies comprising the printer. On the page facing each illustration is a list of the illustrated parts and their part numbers.

  Section II begins on page 259.

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Preparing the Printer for Maintenance

IMPORTANT

DO NOT attempt field repairs of electronic components or assemblies. Replace a malfunctioning electronic assembly with an operational spare. Most electronic problems are corrected by replacing the circuit board, sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank coils and electronics: you must replace the entire shuttle frame assembly. It is not field repairable. (Hammer spring assemblies are the only replaceable components of the shuttle frame assembly.)

DANGER:

<3> . . Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.

1. Power off the printer.
2. Unplug the printer power cord from the AC power source.
3. Disconnect the host data cable from the printer interface.
4. Open the printer cover.
5. Unload paper.
6. Remove the ribbon.
7. Read the entire adjustment procedure before you begin working on the printer.
8. Gather the necessary parts before you begin working on the printer.

Belt, Paper Feed Timing

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Cabinet Model: Loosen four screws and remove the barrier shield. (See page 269, Figure 43, items 3 and 4.)
   Pedestal Model: Loosen the four screws securing the paper guide and barrier shield. Remove the paper guide and barrier shield. (See page 271, Figure 44, items 3, 4, and 5.)
4. Remove the timing belt cover by squeezing the front and back to release the plastic tabs from the slots in the side plate (page 269, Figure 43).
5. Loosen (do not remove) the paper feed motor mount screws (page 285, Figure 50).
6. Loosen the setscrew in the paper feed motor pulley collar.
7. Remove the paper feed timing belt by sliding the paper feed motor pulley off the motor shaft and the belt off the splined shaft pulley.

Installation

1. Install the paper feed timing belt over the splined shaft pulley and the motor pulley. Slide the motor pulley onto the paper feed motor shaft (page 285, Figure 50).
2. Holding a 0.040 inch feeler gauge between the pulley collar and the motor body, torque the 7/64 inch collar screw to 25 ± 2 inch-pounds (2.82 ± 0.23 N•m).
3. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor near the mounting base of the motor. Use the splined shaft to steady the gauge.
4. Reduce tension to 12 pounds (53.4 N) and torque the paper feed motor mount bolts to 18 ± 2 inch-pounds (2.03 ± 0.23 N•m).
5. Snap the timing belt cover into the slots in the side plate (page 269, Figure 43).
6. Cabinet Model: Install the barrier shield and tighten the four screws. (See page 269, Figure 43, items 3 and 4.)
   Pedestal Model: Install the barrier shield and paper guide and tighten the four screws. (See page 271, Figure 44, items 3, 4, and 5.)
7. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).
8. Return the printer to normal operation (page 159).

Belt, Platen Open

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 283, Figure 49).
4. Loosen (do not remove) the two motor mount screws (page 285, Figure 50).
5. Push the motor toward the front of the printer to loosen the platen open belt.
6. Loosen the setscrew in the platen open motor pulley.
7. Remove the platen open belt by sliding the platen motor pulley off the motor shaft and the belt off the platen open pulley.

Installation

1. Slide the platen open timing belt over the platen open pulley and the motor pulley and tighten the 1/16 inch setscrew.
2. Slide the motor pulley onto the platen open motor shaft and tighten the pulley setscrew.

ATTENTION

Too much tension on the platen open belt can cause the platen gap to change, which can lead to premature wear of the platen, damaged hammer tips, and poor print quality.

3. Using a force gauge, apply 10 pounds (44.48 N) of tension to the motor shaft by pushing in the direction away from the large platen pulley.
4. Reduce tension to 5 pounds (22.24 N) and torque the motor mount screws to 11 ± 2 inch-pounds (1.24 ± 0.23 N•m).
5. Snap the platen open belt cover into the slots in the side plate.
6. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).
7. Return the printer to normal operation (page 159).

Cable Connectors and Connector Shells

Some of the printer cable connectors are grouped inside connector shells. The procedure below explains how to remove and install cable assemblies from any connector shell in the printer.

NOTE: There is also a diagram of the P106 / P107 connector shells on the plastic cover over the power supply.

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Disconnect the cable connector shell containing the cable assembly that will be replaced.
4. Pull the side of the connector shell outward and gently pull the cable connector upward. (See Figure 30.) Notice that two-wire connectors are grouped across from two-wire connectors in a connector shell. Four-wire connectors are grouped across from four-wire connectors in a connector shell.
5. Disengage the lock tab(s) on the cable connector from the slots in the side of the connector shell.
6. Remove the cable connector from the connector shell. (Remove only the cable connector for the cable you are replacing; leave the rest in the shell.)

Installation

1. Position the cable connector in the connector shell. Two-wire connectors are always grouped across from two-wire connectors in a connector shell. Four-wire connectors are always grouped across from four-wire connectors in a connector shell. (See Figure 30.)
2. Pull the side of the connector shell outward and gently push the cable connector down into the connector shell.
3. Engage the tabs on the cable connector in the slots in the side of the connector shell. Press the sides of the connector shell inward to make sure all cable connector tabs are engaged in the shell slots.
4. Connect the cable connector shell to its printer connection.

5. Cabinet Model: Install the paper path (page 235).
   Pedestal Model: Install the top cover assembly (page 210).

6. Return the printer to normal operation (page 159).

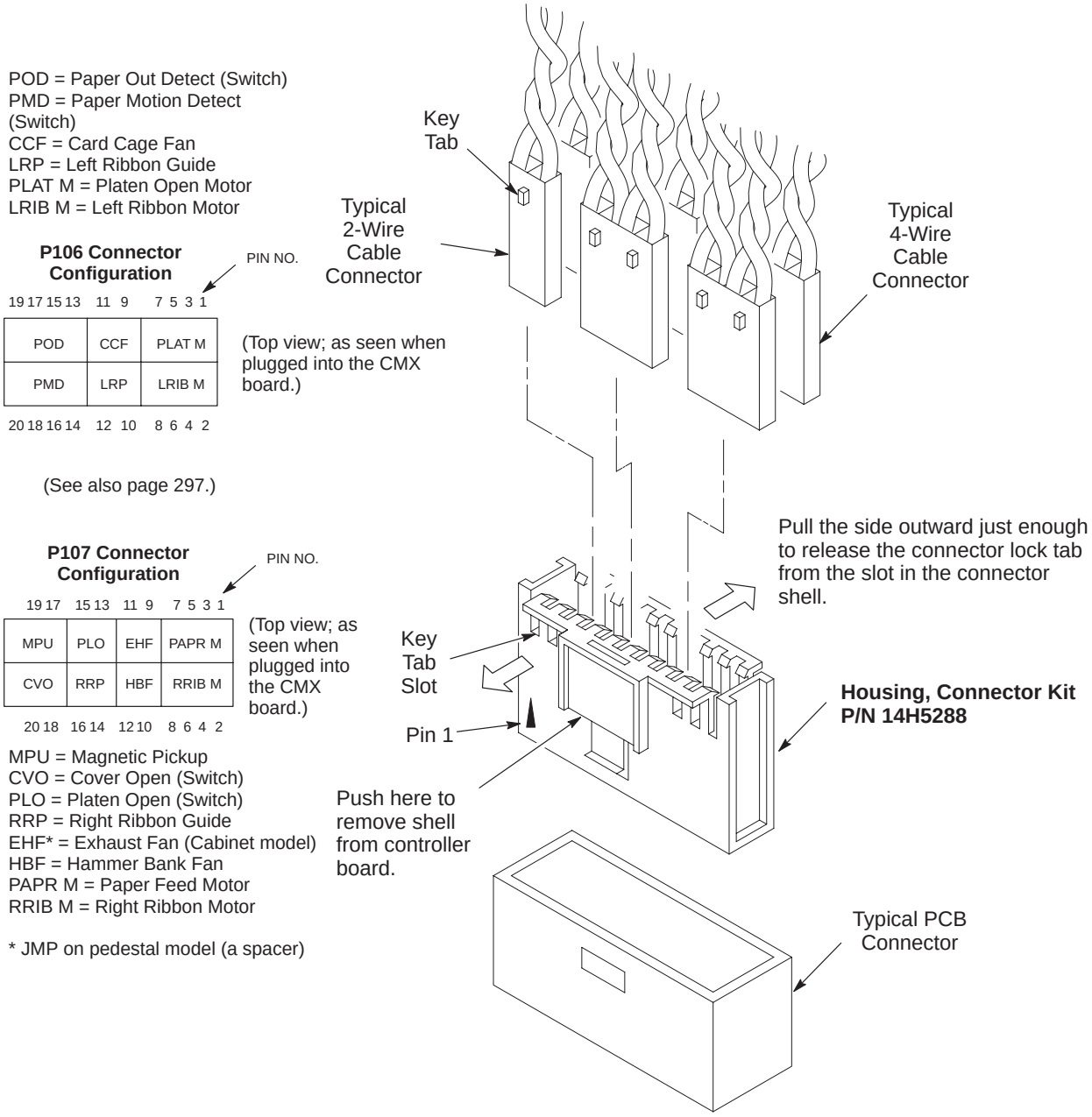

POD = Paper Out Detect (Switch)
PMD = Paper Motion Detect (Switch)
CCF = Card Cage Fan
LRP = Left Ribbon Guide
PLAT M = Platen Open Motor
LRIB M = Left Ribbon Motor
P106 Connector Configuration
PIN NO.
19 17 15 13 11 9 7 5 3 1
POD
CCF
PLAT M
PMD
LRP
LRIB M
20 18 16 14 12 10 8 6 4 2
(Top view; as seen when plugged into the CMX board.)
(See also page 297.)
P107 Connector Configuration
PIN NO.
19 17 15 13 11 9 7 5 3 1
MPU
PLO
EHF
PAPR M
CVO
RRP
HBF
RRIB M
20 18 16 14 12 10 8 6 4 2
(Top view; as seen when plugged into the CMX board.)
MPU = Magnetic Pickup
CVO = Cover Open (Switch)
PLO = Platen Open (Switch)
RRP = Right Ribbon Guide
EHF* = Exhaust Fan (Cabinet model)
HBF = Hammer Bank Fan
PAPR M = Paper Feed Motor
RRIB M = Right Ribbon Motor
* JMP on pedestal model (a spacer)
Key Tab
Typical 2-Wire Cable Connector
Typical 4-Wire Cable Connector
Pull the side outward just enough to release the connector lock tab from the slot in the connector shell.
Key Tab Slot
Pin 1
Housing, Connector Kit P/N 14H5288
Push here to remove shell from controller board.
Typical PCB Connector

Figure 30. Cable Shell Connector, Disassembly/Assembly

Circuit Board: Controller

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

NOTE: 6400–050, –P50, –010, –P10, –014, and –015 printers must use the 40 MHz CMX controller board.

Removal

1. Make a configuration printout of all configurations. (Refer to the *Operator's Guide*.)
2. Prepare the printer for maintenance (page 194).
3. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
4. Disconnect all cable connectors from the controller board. (See page 275, Figure 45.)
5. Loosen, but do not remove, the screws securing the controller shield near serial cable connector J201.
6. Loosen, but do not remove, the screw securing the controller shield to the bottom of the card cage, on the left side near the card cage fan.
7. Slide the controller board to left until the keyway clears the screw securing the controller board to the bottom of the card cage.
8. Remove the controller board.
9. Remove the DRAM SIMM, FLASH SIMM, and Security PAL from the controller board (page 224). These will be installed on the replacement controller board. The Security PAL must be installed on the replacement controller board to ensure the printer functions correctly.

NOTE: When Flash SIMMs are removed from one controller board and placed on another controller board, the SIMMs must be placed on the new board in the same order and location as on the original board.

Installation

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

NOTE: When flash SIMMs are removed from one controller board and placed on another controller board, the SIMMs must be placed on the new board in the same order and location as on the original board.

1. Install the DRAM SIMM, Flash Memory, and Security PAL on the controller board (page 224).
2. Position the controller board assembly in the card cage, shield side down, component side up. Engage the screw on the bottom of the card cage in the keyway in the controller shield. Slide the board to right until the serial cable connector J201 on the board lines up with the cutout in the card cage. (See page 275, Figure 45.)
3. Tighten the screw securing the controller shield near serial cable connector J201.
4. Tighten the screw securing the controller shield to the bottom of the card cage.
5. Connect all cable connectors to the controller board, using the Interconnection diagram on page 295 as your guide.
6. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).

IMPORTANT

If the original CMX board was replaced, you must download the emulation software again. Installing flash memory from the old board onto the new board does not transfer all operating system software.

7. Load flash memory (page 181).
8. Models –014 and –015 only: adjust the coil temperature if the original CMX board was replaced (page 188).
9. Models –004, –04P, –005, and –05P only: set shuttle speed if the original CMX board was replaced (page 189).

10. Adjust the hammer phasing (page 179).
11. Adjust the end of forms distance (page 175).
12. Return the printer to normal operation (page 159).
13. Using the configuration printout you made as step 1 of the removal procedure, reset and save the printer configuration.

Circuit Board: Power Supply

CAUTION:

<4> To prevent injury from electric shock, wait at least one minute after powering off before removing the power supply board.

ATTENTION

Do not touch components or flex the board during removal/installation. Handle the board by the ejection levers and the sides. Wear a properly grounded static wrist strap when handling the power supply board.

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Disconnect output connector P101 from the controller board and AC input connector P1 from the power supply board.
4. Loosen three captive screws securing the power supply board to the rear wall of the card cage. (See 275, Figure 45, item 4.)
5. Carefully disengage the power supply board from the three standoffs on the rear wall of the card cage.
6. Remove the power supply board from the card cage.

Installation

1. Position the power supply board over the three standoffs on the rear wall of the card cage and gently push the board until it engages fully on the standoffs.
2. Install three screws securing the power supply board to the rear wall of the card cage. (See 275, Figure 45, item 4.)
3. Connect output connector P101 to the controller board and AC input connector P1 to the power supply board.
4. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).
5. Return the printer to normal operation (page 159).

Circuit Breaker

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Remove the card cage fan (page 216).
4. Disconnect the four circuit breaker electrical leads.
   (Cabinet Model: See Figure 51, page 287.
   Pedestal Model: See Figure 44a, page 273.)
5. Press in on the spring clips and remove the circuit breaker from the printer.

Installation

1. Press the circuit breaker into the cutout until the spring clips snap into place.
   (Cabinet Model: See Figure 51, page 287.
   Pedestal Model: See Figure 44a, page 273.)

ATTENTION

Make sure the four leads are connected as shown on page 287 (Figure 51).

2. Connect the four circuit breaker electrical leads.
   (Cabinet Model: See Figure 51, page 287.
   Pedestal Model: See Figure 44a, page 273.)
3. Install the card cage fan (page 216).
4. Return the printer to normal operation (page 159).

Coax/Twinax Multi-Platform Interface

NOTE: Installation, operation, and replacement parts for this optional feature are covered in detail in the *Coax/Twinax Multi-Platform Interface Feature Installation and Operation Guide*, Form Number S246–0149.

Removal

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 158).
2. Refer to the *Coax/Twinax Multi-Platform Interface Feature Installation and Operation Guide*, Form Number S246–0149.

Installation

1. Refer to the *Coax/Twinax Multi-Platform Interface Feature Installation and Operation Guide*, Form Number S246–0149.

Cover Assembly, Hammer Bank / Ribbon Mask

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the shuttle frame assembly (page 249).
3. Early models:

   Lift the thick plate of the hammer bank cover assembly at one end, and peel the cover away from hammer bank magnets. (See Figure 31, page 208.)

4. Later models:

   a. Using a Torx T-10 driver, remove the six screws and three ribbon mask clamp plates securing the ribbon mask to the hammer bank cover. Remove the ribbon mask. (See Figure 31, page 208.)

NOTE: If you are replacing just the ribbon mask, simply loosen the six screws until you can slip the ribbon mask off the alignment pins.

   b. Using a Torx T-10 driver, remove the 12 screws securing the hammer bank cover to the hammer bank. Remove the hammer bank cover. (See Figure 31, page 208.)

Installation

ATTENTION

The hammer bank contains a strong magnet. To prevent damage to the hammer tips, do not let the hammer bank cover assembly snap into place as the hammer bank magnet attracts it. Any impact of the cover against the hammer bank can break hammer tips.

1. Early models:

    a. With the thick plate facing the hammer bank, engage the bottom edge of the hammer bank cover assembly on the alignment pins. Engage the round hole first, then the oblong hole, to ensure that the cover lies flat on the hammer bank.

    b. Gently lower the hammer bank cover assembly until it lies flush on the hammer bank.

    c. Check that the hammer bank cover assembly is properly positioned over the alignment pins and hammer tips.

2. Later models:

    a. Position the hammer bank cover on the allignment pins on the hammer bank. Make sure the hammer bank cover is properly positioned over the alignment pins and hammer tips and lies flat on the hammer bank.

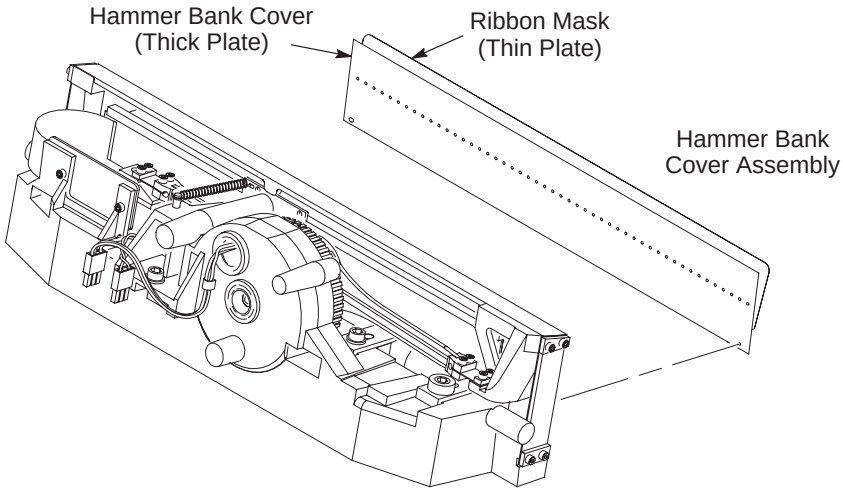
    b. Install all 12 hold-down screws finger tight. Using a Torx T-10 driver, torque the 12 hold-screws to 14 inch-pounds (1.58 N•m) in the sequence shown in Figure 31 on page 208.

    c. With the seam of the folded lower edge of the ribbon mask facing inward (toward the hammer bank cover), position the ribbon mask on the allignment pins on the hammer bank cover. The ribbon mask is correctly installed when the angled ends of the ribbon mask match the angled ends of the hammer bank cover. Install the three clamp plates and six screws finger tight. Using a Torx T-10 driver, torque the six screws to 14 inch-pounds (1.58 N•m) in the sequence shown in Figure 31 on page 208.

3. Install the shuttle frame assembly (page 249).

4. Return the printer to normal operation (page 159).

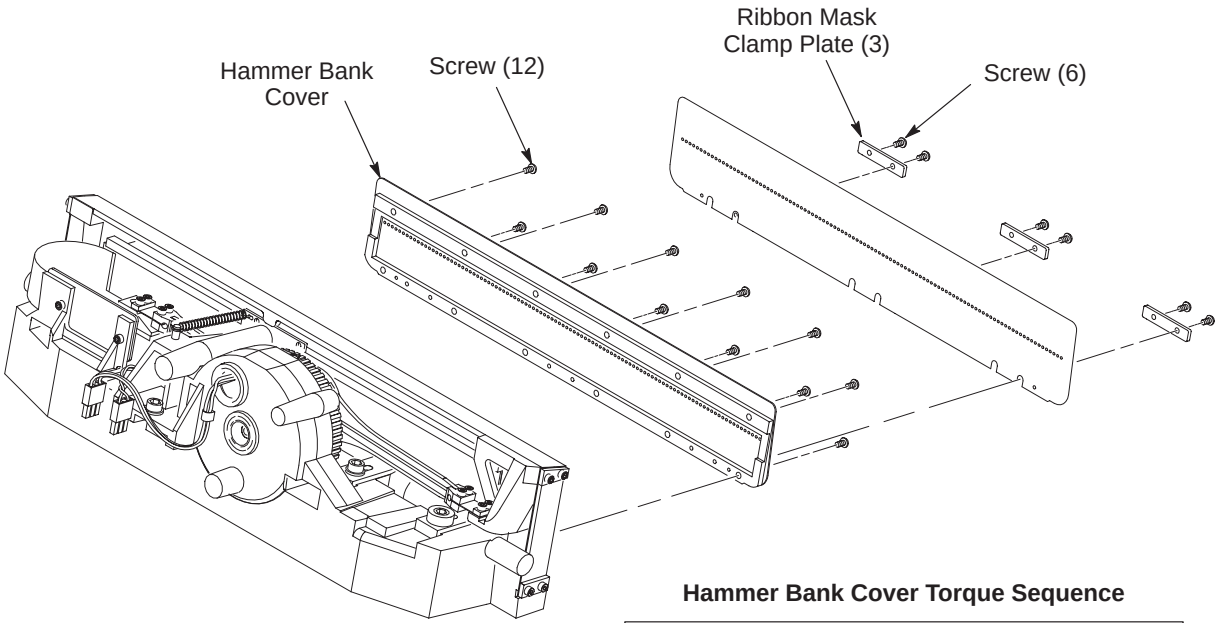
Early Models



Later Models

Ribbon Mask Torque Sequence

4	3		1	2	
				5	6



Hammer Bank Cover Torque Sequence

9	5	1	3	7	11
10	6	2	4	8	12

Figure 31. Hammer Bank Cover Assembly / Ribbon Mask

Cover Assembly, Shuttle

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Remove the ribbon spools.
4. Loosen the shuttle cover screws (page 269, Figure 43).
5. Grasping the edges of the shuttle cover assembly, tilt up the rear edge and lift the shuttle cover assembly out of the printer.

Installation

1. Place the shuttle cover assembly in the printer. Tilt the forward edge of the cover down slightly and work the cover into position (page 269, Figure 43).

NOTE: Make sure the holes in the cover are over the locating pins.

2. Tighten the shuttle cover screws (page 269, Figure 43).
3. Return the printer to normal operation (page 159).

Cover Assembly, Top, Pedestal Model

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the operator panel (page 234).
3. Remove five screws and the control panel bracket. (See Figure 42, page 267, items 3 and 4.)
4. Loosen the two captive #2 Phillips screws in the lower front corners of the top cover. (See Figure 42, page 267, item 14.)
5. Loosen, but do not remove, the two #2 Phillips hold-down screws on the rear of the printer. (See Figure 42, page 267, item 8.)
6. Lift the top cover assembly off the printer base.

Installation

To install the top cover assembly, reverse the steps of the removal procedure.

Doors, Cabinet, Reversing

NOTE: Floor cabinet printers are assembled with the front door hinged on the left side so that it opens at the right side. The rear door is hinged on the right side so that it opens on the left side. This procedure enables you to reverse this door configuration.

1. Open the front and rear cabinet doors.
2. Mark the top of each door.
3. Remove the screws and wire ropes from the doors and cabinet frame. (See Figure 39, page 261, item 9.)
4. Lift each door up and off the hinge pins of the upper and lower cabinet hinge plates. Do not remove the hinge plates from the doors.
5. Remove two screws and the paper fence from the original rear door.
6. Remove the screws securing the hinge pin plates to the front and rear of the cabinet. Remove the hinge plates and the pads beneath the plates.
7. Install pads and hinge pin plates to the right front side of the frame, with the hinge pins up and toward the outside edge of the printer frame.
8. Install pads and hinge pin plates to the left rear side of the frame, with the hinge pins up and toward the outside edge of the printer frame.
9. Move the original rear door to the front of the printer. With the marked top uppermost, slide the door hinges down onto the hinge pins. Adjust the position of the hinge pin plates as necessary so the door closes squarely against the frame.
10. Move the original front door to the rear of the printer. With the marked top uppermost, slide the door hinges down onto the hinge pins. Adjust the position of the hinge pin plates as necessary so the door closes squarely against the frame.
11. Install the paper fence to the “new” rear door with the two screws.
12. Install the wire ropes to the doors and the cabinet frame.

Ethernet Interface Assemblies

NOTE: The Ethernet LAN option is available in 10-Base-T or 10-Base-2 configuration, and is available factory installed or in a field kit. Removal and installation is the same for all versions. The LEDs and DIP switches on the Ethernet Interface board are described on page 213.

Removal

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 158).
2. Cabinet Models: Remove the paper path (page 235).
   Pedestal Models: Remove the top cover assembly (page 210).
3. Disconnect Centronics cable connector P112 from connector J112 on the CMX controller board. (See Figure 53, page 291.)
4. Open the ferrite clamp and lift the Centronics cable out of the ferrite clamp.
5. Loosen the two screws securing the Ethernet interface assembly to the cutout at the rear of the card cage.
6. Slide the Ethernet interface assembly out of the cutout in the card cage and lift the assembly out of the card cage.

Installation

ATTENTION

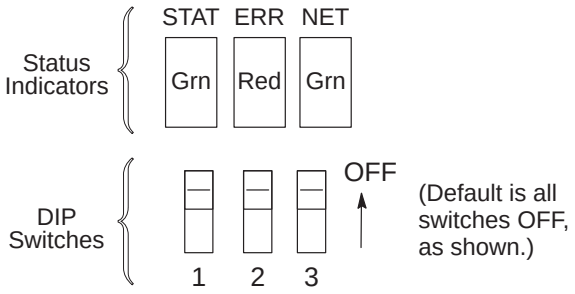
To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 159).

Ethernet Interface LEDs and DIP Switches

The Ethernet Interface has three LEDs and three DIP switches, as shown below. These indicators and switches are adjacent to the data line connectors. LED patterns are defined in the table below the illustration.

Status Indicator LEDs and DIP Switches



LED Pattern Indications

STAT (System Status)	ERR (System Error)	NET (Data to Network)	Mode
ON	OFF	ON	RAM Test
ON	OFF	OFF	ROM Test
ON	ON	OFF	EEPROM Test
OFF	ON	ON	Network Interface Test
OFF	OFF	ON	PRN1 Test
FLASH	OFF	FLASH	Run Mode
FLASH	ON	FLASH	Auto Reset Mode
FLASH	FLASH	OFF	Firmware Panic
ON	FLASH	ON	Hardware Exception

The Ethernet Interface Assembly has a self test and two internally controlled modes:

Power-on Self Test: A seven stage power-on self test performs diagnostics on the Ethernet Interface processor, RAM, ROM, EEPROM, parallel port, and network interface. The STAT, ERR, and NET LEDs indicate which test is currently in progress.

Run and Auto Reset Modes: Run Mode is the normal operating state of the Ethernet Interface. Auto Reset mode is entered when the watchdog timer is triggered and the Print Server resets itself. In either mode, the STAT LED flashes differently depending on whether the unit IP address is configured.

The Run Mode and Auto Reset Mode indicator descriptions are shown below.

Run Mode and Auto Reset Mode Indicator Descriptions

STAT	Rate	Indicates
Flashes On	once per second	Normal Mode, IP address configured
Flashes On	2.5 times per second	Monitor Mode, IP address not configured
Flashes Off	2.5 times per second	Monitor Mode or Download Mode, IP address not configured
Flashes Off	once per 2 seconds	Download Mode, IP address configured

IMPORTANT

Setting DIP Switch 1 and DIP Switch 2 both to the ON (down) position will clear all passwords, specifically passwords in the html webpage.

DIP Switch 1 = EEPROM Enable: Default position is OFF (up). Setting this switch to the ON (down) position and powering the printer off then on resets the Ethernet Interface to the factory default settings. This also erases any previously configured IP address. Before reconfiguring the unit, DIP switch 1 must be set back to the OFF (up) position, otherwise it will lose its configuration through another power on/off cycle.

DIP Switch 2 = Default IP: Default position is OFF (up). Setting this switch to the ON (down) position and powering the printer off then on resets a previously configured IP address to the factory default setting (no IP address). However, this does not cause the unit to lose its other stored configuration setting, as happens with DIP switch 1. Before reconfiguring the unit with an IP address, DIP switch 2 must be set back to the OFF (up) position, otherwise it will lose its IP address through another power on/off cycle.

DIP Switch 3 = Link Integrity Disable: Default position is OFF (up), which means link integrity is **enabled**. This DIP switch determines whether link integrity is turned on or off in the Ethernet interface. It may be necessary to turn link integrity off if the unit is connected to an older hub, etc. Link integrity only applies to the 10-Base-T interface option.

Fan Assembly, Cabinet Exhaust

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the floor cabinet doors and the printer cover.
3. Remove the paper stacker. (See Figure 40, page 263.)
4. Remove the three screws securing the air exhaust duct. (The top screw is located near the right front of the card cage, in front of the square air holes in the printer base plate.) (See page 265, Figure 41).
5. Disconnect the fan cable connector from connector P307 and remove the air exhaust duct.
6. Remove the fan cable connector from the cutout in the side of the air exhaust duct.
7. Remove the two fan mounting screws and the cabinet exhaust fan assembly.

Installation

ATTENTION

Make sure to install the fan so that air flow is down.

1. Position the cabinet exhaust fan assembly in the air exhaust duct so that air flow is down, and install the two screws securing the fan to the duct. (See page 265, Figure 41).
2. Snap the fan cable connector into the cutout in the side of the air exhaust duct.
3. Move the air exhaust duct back into position and install the three screws.
4. Connect the cabinet exhaust fan cable connector to connector P307.
5. Install the paper stacker. (See Figure 40, page 263.)
6. Return the printer to normal operation (page 159).

Fan Assembly, Card Cage

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Disconnect the fan cable connector:
   Cabinet Model, Figure 50, page 285.
   Pedestal Model, Figure 44a, page 271.
4. Cabinet Model: Remove the two fan mounting screws from the bottom of the fan. (See Figure 50, page 285, item 2.)
   Pedestal Model: Remove the four fan mounting screws and nut. (See See Figure 44a, page 273, items 1 through 4.)
5. Remove the card cage fan assembly from the card cage.
6. Remove the screw securing the shield to the card cage fan.

Installation

ATTENTION

Make sure to install the fan so the label faces toward the inside of the printer. Air flow is INTO the card cage.

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 159).

Fan Assembly, Hammer Bank

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the shuttle cover assembly (page 209).
3. Pedestal Model: Remove the top cover assembly (page 210).
4. Trace the hammer bank fan cable assembly back to the controller board connector J107, releasing it from all cable constraints. (See the cable routing diagram on page 306.)
5. Disconnect connector P107 from the controller board and remove the fan connector (HBF) from on the controller board. (Refer to page 198.)
6. Remove the two screws securing the fan to the base casting. Angle the hammer bank fan assembly up and out of the base casting and feed the motor wires and cable connector out from between the base casting and the base pan. (See Figure 50, page 285.)

Installation

ATTENTION

Make sure to install the fan so the label faces up. Air flow is UP.

NOTE: The hammer bank fan assembly is installed by angling it down and under the shuttle motor.

1. Feed the hammer bank fan cable connector (HBF) and motor wires between the fan well of the base casting and the base pan. Reach up under the base casting and route the fan cable to the right and angle the hammer bank fan assembly under the shuttle motor and down into the fan well. (See Figure 50, page 285.)
2. Route the fan motor wires as shown on page 306, connect fan cable connector (HBF) to P107, then connect P107 to J107 on the controller board. (See page 198.)
3. Install two screws in the locations shown in Figure 45 (page 275).
4. Pedestal Model: Install the top cover assembly (page 210).
5. Install the shuttle cover assembly (page 209).
6. Return the printer to normal operation (page 159).

Hammer Spring Assembly

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the shuttle frame assembly (page 249).
3. Carefully vacuum the shuttle frame assembly.
4. Remove the hammer bank cover assembly (page 206).

ATTENTION

Hammer springs and hammer tips are fragile. Do not touch the hammer springs or tips. Handle hammer springs by the thick mounting base only. Apply pressure only to the mounting base.

NOTE: Replace a hammer spring assembly only if there is visible damage or broken parts can be seen in the assembly.

5. Remove the mounting screws from the old hammer spring assembly. (See Figure 32, page 219.)
6. Handling the hammer spring assembly by the mounting base only, gently pry the old hammer spring assembly off its mounting pins. (See Figure 32, page 219.)
7. Inspect the hammer bank and the old hammer spring assembly:
    a. If there is ink on the hammer bank mounting surface, the hammer spring assembly mounting surface, or the hammer spring neck or tines, reinstall the old hammer spring assembly and replace the shuttle frame assembly (page 249).
    b. If the old hammer spring assembly and the hammer bank are free of ink, install the new hammer spring assembly (page 220).

NOTE: The hammer spring assemblies shown below are for 6400–004**,** 04P**,** 005**,** 05P printers. The number of hammer springs and mounting screws varies among printer models, but hammer spring removal is the same.

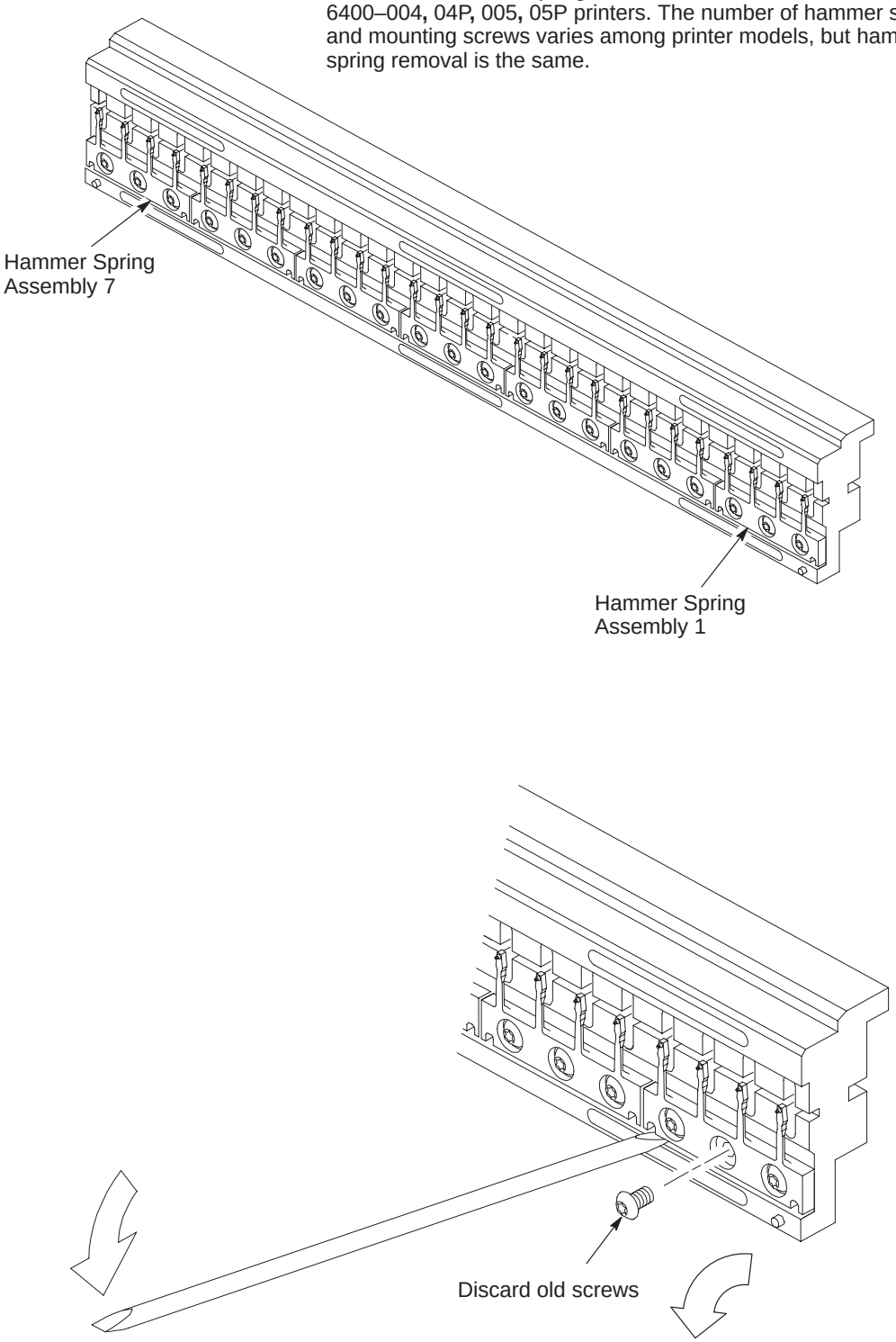


Figure 32. Hammer Spring Assembly, Removal

Installation

NOTE: 6400–050, –P50, –010, –P10, –014, and –015 printers must use the CMX 040 controller board.

1. Using a clean dry cloth, wipe the hammer spring mounting surface on the hammer bank. Make sure the cloth does not leave lint on the hammer bank.

ATTENTION

Hammer springs and hammer tips are fragile. Do not touch the hammer springs or tips. Handle hammer springs by the thick mounting base only. Apply pressure only to the mounting base.

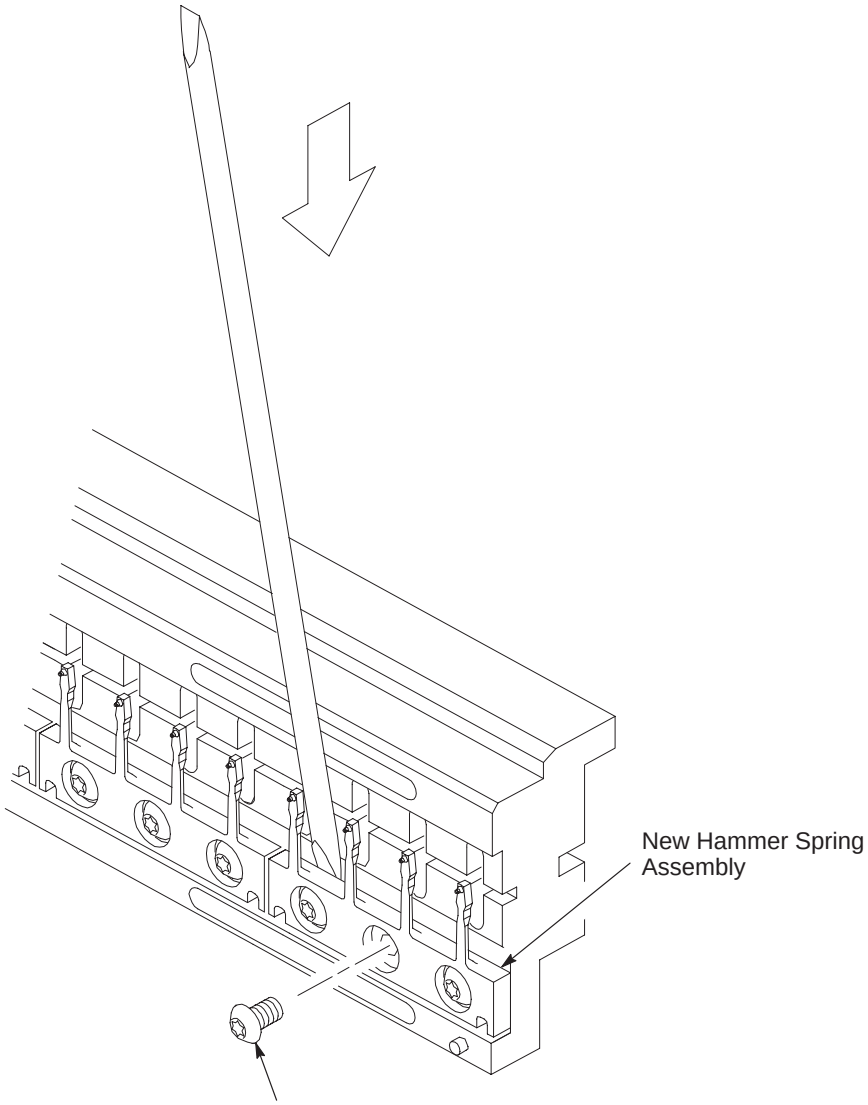
NOTE: Replace a hammer spring assembly only if there is visible damage or broken parts can be seen in the assembly.

2. Handling it by the mounting base only, remove the new hammer spring assembly and mounting screws from the box.
3. Handling the hammer spring assembly by the mounting base only, carefully position the new hammer spring assembly onto the hammer bank mounting pins and press it into position with the flat end of the stick supplied in the hammer spring replacement kit. (See Figure 33, page 221.)
4. Install the mounting screws from the replacement kit. Using a Torx** T-10 bit adapter, torque each screw to 14 in-lbs (1.58 N•m). Tighten the center screw(s) first. (See Figure 33, page 221.)
5. Install the hammer bank cover assembly (page 206).
6. Install the shuttle frame assembly (page 249).
7. Install the ribbon and load paper.

ATTENTION

Do not attempt to adjust or “tweak” hammer springs.

8. Run a Customer Engineer Test and check print quality (page 140):
    a. If print quality is acceptable, return the printer to normal operation (page 159).
    b. If print quality is still degraded, replace the shuttle frame assembly (page 249).



NOTE: The hammer spring assemblies shown above are for 6400–004**,** 04P**,** 005**,** 05P printers. The number of hammer springs and mounting screws varies among printer models, but installation procedure and torque values are the same.

Figure 33. Hammer Spring Assembly, Installation

IBM Coax/Twinax Expansion Board

Removal

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Loosen, but do not remove, the two screws securing the coax/twinax I/O plate to the rear of the card cage. Loosen the thumbscrew on the CT board until the screw is released from the standoff on the controller board. (See Figure 52, page 289.)
4. Carefully lift the expansion-CT board out of the card cage cutout and off the expansion connector adapter that attaches the CT to the CMX board.
5. Remove the expansion connector adapter from the CMX controller board by carefully lifting it straight up and out of the controller connector.

Installation

1. Reverse steps 2 through 5 of the removal procedure.
2. Return the printer to normal operation (page 159).

Magnetic Pick-up (MPU) Assembly

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the shuttle cover (page 209).
3. Disconnect the shuttle cable assembly connector (page 275, Figure 45).
4. Disconnect the magnetic pick-up (MPU) cable connector (page 279, Figure 47).
5. Loosen the 7/64 inch hex MPU clamp screw (page 279, Figure 47).
6. Unscrew the MPU assembly from the MPU bracket.

Installation

1. Install the MPU assembly by screwing it into the MPU bracket (page 279, Figure 47).
2. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the MPU clamp screw to 19 ± 1 inch-pounds (2.15 ± 0.11 N•m).
3. Check the gap between the MPU assembly and the flywheel with a feeler gauge:
   a. If the gap is 0.010 ± .001 inch (0.254 ± 0.025 mm), go to step 4.
   b. If the gap is not 0.010 ± 0.001 inch (0.254 ± 0.025 mm), loosen the MPU clamp screw and go back to step 2.

ATTENTION

Make sure the MPU cable is below the extension spring and does not touch the spring after the cable is connected.

4. Connect the magnetic pick-up (MPU) cable connector.
5. Connect the shuttle cable assembly connector (page 279, Figure 47).
6. Install the shuttle cover (page 209).
7. Adjust the hammer phasing (page 179.)
8. Return the printer to normal operation (page 159).

Memory Modules and Security PAL

Removal

1. Make a configuration printout of all configurations. (Refer to the *Setup Guide*.)
2. Prepare the printer for maintenance (page 194).
3. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

NOTE: If flash SIMMs are removed from one controller board and placed on another controller board, the SIMMs must be placed on the new board in the same order and location as on the original board.

4. Gently pry the side locks open, angle the SIMM toward the front of the printer, and remove the SIMM from the socket. (See Figure 34, page 226 for the locations of memory modules.)
5. Using a module extraction tool, remove the security PAL. (See Figure 34, page 226.)

Installation

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

NOTE: Flash SIMMs from one CMX controller board must be placed in the same slot on a replacement CMX controller board. Installing flash memory from one controller board to another does transfer all operating system software, so you must download the emulation again.

1. Insert the memory module into the correct socket on the CMX controller board:

   a. Position the SIMM so the notched end is toward the right-hand side of board. (See Figure 34, page 226.)

   b. Press the SIMM into the socket with the top of the SIMM angled *away* from the center of the board. When the SIMM is seated in the socket, *gently* push on the ends until it locks in the upright position.

2. Install the security PAL. (See Figure 34, page 226.)

3. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).

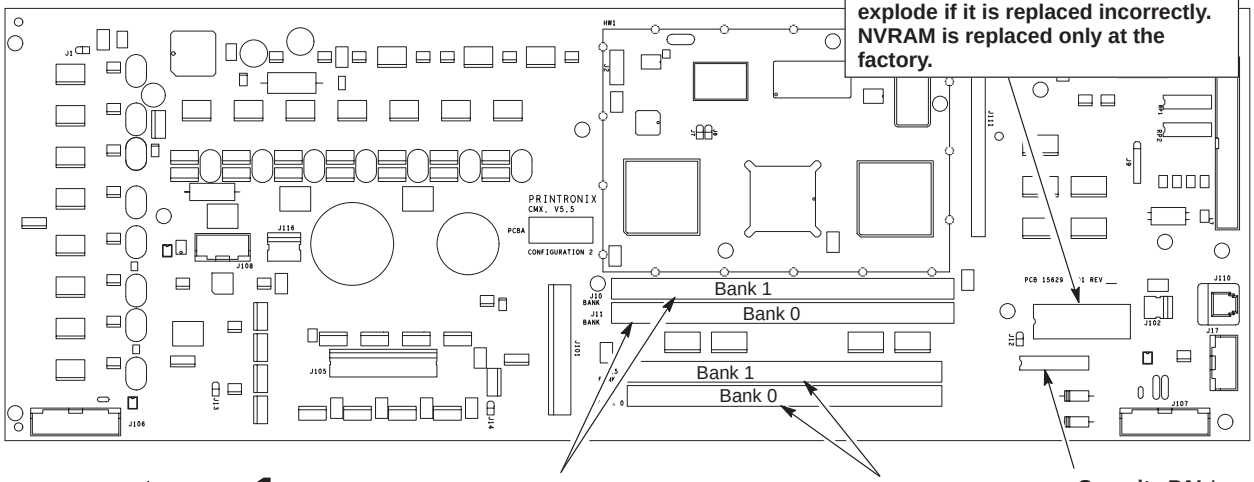
4. Download the emulation (page 181).

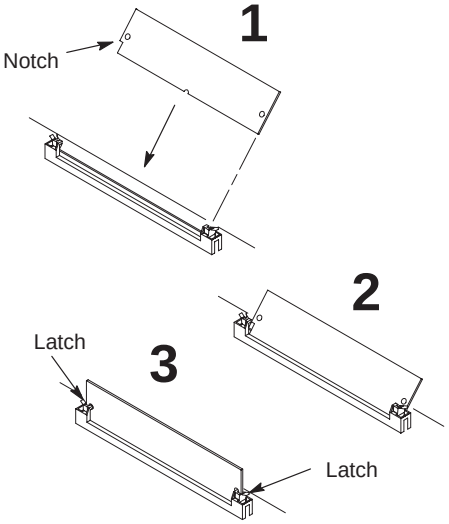
5. Return the printer to normal operation (page 159).

6. Using the configuration printouts you made as step 1 of the removal procedure, reset and save the printer configurations. (Refer to the *Setup Guide*.)

CMX Controller Board

CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.





Flash Memory:

80-pin SIMM

J11 = Bank 0
Must always be filled

J10 = Bank 1
Reserved for upgrades

If 1 Flash SIMM, use Bank 0

If 2 Flash SIMMs, use both banks, but be sure to place pre-programmed SIMMs in the marked location

DRAM:

72-pin SIMM

J16 = Bank 0 (must always be filled)
1MB SIMM standard in LP+ option

J15 = Bank 1
Reserved for upgrades

If 1 DRAM SIMM, use Bank 0

If 2 DRAM SIMMs, use both banks (It does not matter which SIMM goes into which bank)

Security PAL*

IMPORTANT: No matter what combination of SIMMs is used, J11 and J16 must always be filled. Flash SIMMs from one CMX controller must be placed in the same slots on another controller board.

* Security PAL, Base: 14H5509
Security PAL, Graphics: 14H5490

Blank SIMMs:
1MB Flash – 14H5539
2MB Flash – 14H5540
1MB DRAM – 14H5499
2MB DRAM – 14H5481
4MB DRAM – 14H5508

Minimum Memory Requirements: 050, P50, 010, P10, 015

Datastream	ASCII	ASCII IGP Code V	CTA	CTA IGP Code V	IPDS CTA	IPDS CTA IGP Code V
Flash Memory	2 MB	2 MB	2MB	2MB	2 MB	3 MB
DRAM	2 MB	3 MB	2MB	3 MB	6 MB	8 MB
CT Board Installed	No	No	Yes	Yes	Yes	Yes
Security PAL Vendor P/N	154143–002 (14H5509)	154143–001 (14H5490)	154143–002 (14H5509)	154143–001 (14H5490)	154143–002 (14H5509)	154143–001 (14H5490)

Figure 34. Memory Modules and Security PAL

Motor Assembly, Paper Feed

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Cabinet Model: Loosen four screws and remove the barrier shield. (See Figure 43, page 269, items 3, 4, and 9.)
   Pedestal Model: Remove the four screws, the barrier shield, and the paper guide. (See Figure 44, page 271, items 3, 4, and 5.)
4. Remove the timing belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 269, Figure 43).
5. Loosen the paper feed motor mount screws (page 285, Figure 50).
6. Loosen the shaft collar setscrew and remove the paper feed motor pulley, shaft collar, and paper feed timing belt (page 285, Figure 50).
7. Trace the paper feed motor cables back to the controller board, releasing it from tie wraps. (See the cable routing diagram on page 306.)
8. Disconnect connector P107 from the controller board and remove the paper feed motor connector from connector P107. (See page 198.)

NOTE: Some paper feed motors are mounted with nuts and bolts; other motors have threaded flanges, eliminating the need for nuts.

9. Remove the motor mount bolts (and nuts, if present).
10. Remove the paper feed motor assembly.

Installation

1. Position the paper feed motor assembly on the right side plate and install the motor mount bolts and nuts finger tight (page 285, Figure 50).
2. Connect the paper feed motor cable connector to connector P107, then connect P107 to J107 on the controller board. (See page 198.)
3. Install the collar, paper feed motor pulley, and timing belt.
4. Align the paper feed motor pulley with the splined shaft pulley.

ATTENTION

Make sure there is at least 0.040 inches (1.016 mm) of clearance between the collar/pulley and the motor face plate.

5. Hold the collar snug against the motor pulley and torque the setscrew to 25 ± 2 inch-pounds (2.82 ± 0.23 N•m).
6. Using the straight end of a force gauge, apply 12 pounds (53.4 N) of pressure to the paper feed motor. Use the splined shaft to steady the gauge.
7. Reduce pressure to 9 pounds (40.0 N) and torque the motor mount screws to 18 ± 2 inch-pounds (1.36 ± 0.23 N•m).
8. Snap the timing belt cover into the slots in the side plate.
9. Cabinet Model: Install the barrier shield and four screws. (See Figure 43, page 269, items 3, 4, and 9.)
   Pedestal Model: Install the barrier shield, paper guide, and four screws. (See Figure 44, page 271, items 3, 4, and 5.)
10. Cabinet Model: Install the paper guide assembly (page 235).
    Pedestal Model: Install the top cover assembly (page 210).
11. Return the printer to normal operation (page 159).

Motor Assembly, Platen Open

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Cabinet Model: Remove the card cage fan (page 216).
4. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 283, Figure 49).
5. Loosen the two 5/16 inch motor mount screws (page 285, Figure 50).
6. Loosen the 1/16 hex pulley setscrew and remove the motor pulley and platen open belt.
7. Trace the platen open motor cables back to the controller board, releasing the cables from the tie-wraps. (See cable routing diagram on page 306.)
8. Disconnect connector P106 from the controller board.
9. Trace the platen open motor cables to the connector shell and remove the platen open cable connector from the connector shell (page 198).

NOTE: Some platen open motors are mounted with nuts and bolts; other motors have threaded flanges, eliminating the need for nuts.

10. Remove the two 5/16 inch motor mount screws (and nuts, if present).
11. Remove the platen open motor assembly.

Installation

1. Position the platen open motor assembly with the wires toward the rear (page 285, Figure 50).
2. Install the two 5/16 inch motor mount screws (and nuts, if present) finger tight.
3. Install the platen open belt and motor pulley. Bottom out the motor pulley on the motor shaft and tighten the setscrew to 9 ± 2 inch-pounds (1.24 ± 0.23 N•m).
4. Connect the platen motor cable connector to connector shell P106.
5. Connect shell connector P106 to J106 on the controller board. Install tie-wraps to secure the motor cable. (See cable routing diagram on page 306.)
6. Close the forms thickness lever all the way.

ATTENTION

Too much tension on the platen open belt can cause the platen gap to change, which can lead to premature wear of the platen, damaged hammer tips, and poor print quality.

7. Using a force gauge, apply 10 pounds (44.48 N) of tension to the platen open motor shaft by pushing away from the large platen pulley, reduce tension to 5 pounds (22.24 N) and torque the motor mount screws to 11 ± 2 inch-pounds (1.24 ± 0.23 N•m).
8. Snap the platen open belt cover into the slots in the side plate.
9. Cabinet Model: Install the card cage fan (page 216).
10. Cabinet Model: Install the paper guide assembly (page 235).
    Pedestal Model: Install the top cover assembly (page 210).
11. Return the printer to normal operation (page 159).

Motor Assembly, Ribbon Drive

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the ribbon.
3. Remove the ribbon hub (page 245).
4. Remove two screws and washers securing the ribbon drive motor to the base casting (page 285, Figure 50).
5. Lift and rotate the ribbon drive motor until the motor cable is aligned with the slot on the base casting.
6. Disconnect the ribbon drive motor cable connector.
7. Cabinet models: remove the heat boot from the motor. You will install the boot on the replacement motor.

Installation

1. Reverse steps 2 through 7 of the removal procedure above.

NOTE: The ribbon drive motor should be secured at the front right and rear left corners. (See Figure 50, page 285.)

2. Return the printer to normal operation (page 159).

Network Print Server

NOTE: Installation and operation of this optional feature are described in the *Print Server User's Guide*, P/N 30H4056. This guide describes error messages and troubleshooting information. Also provided is a section that describes IBM service procedures.

Removal

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 158).
2. Refer to the *Print Server User's Guide* (P/N 30H4056) for information on determining if the print server is operating correctly.

Installation

Refer to the *Print Server User's Guide* (P/N 30H4056) for information on installing and testing the feature.

Operator Panel Assembly, Cabinet Model

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Remove the four screws securing the operator panel plate to the panel bracket. (See Figure 41, page 265.)
4. Press down on the plastic tab at the upper rear of the panel and slide the operator panel downward on the mounting plate until the tabs on the panel housing slide out of the cutouts.
5. Lift the operator panel assembly and disconnect the phone-style cable connector.

Installation

1. Connect the phone-style operator panel cable to the bottom of the operator panel. (See Figure 41, page 265.)
2. Position the operator panel over the cutouts in the panel plate. Slide the panel upward on the plate until it will slide no further.
3. Position the operator panel and plate on the bracket and install the four screws finger tight. (See Figure 41, page 265.)
4. Slowly lower the printer cover and align the operator panel in the cover cutout. Open the printer cover and tighten the panel plate screws.
5. Return the printer to normal operation (page 159).

Operator Panel Assembly, Pedestal Model

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Tilt the operator panel toward the front of the printer.
4. Disconnect the phone-style cable connector at the rear of the operator panel.
5. Press down on the plastic tab at the upper rear of the panel and slide the operator panel downward on the mounting plate until the tabs on the panel housing slide out of the cutouts.

Installation

1. Tilt the operator panel mounting plate toward the front of the printer.
2. Position the operator panel over the cutouts in the mounting plate and slide the panel upward until the plastic tab at the upper rear of the panel locks into the mounting plate.
3. Connect the phone-style operator panel cable to the bottom of the operator panel.
4. Close the printer cover.
5. Return the printer to normal operation (page 159).

Paper Guide Assembly

NOTE: This procedure applies only to cabinet models.

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Loosen the three paper guide assembly hold-down screws (page 269, Figure 43, item 6).
4. Slide the paper guide assembly to the left and lift it off the card cage.

Installation

1. Position the paper guide assembly offset slightly to the left on the card cage with the keyway cutouts over the three loosened hold-down screws (page 269, Figure 43).
2. Slide the paper guide assembly to the right, engaging the three hold-down screws in the keyway slots. Slide the paper guide assembly to the right as far as it will go.
3. Tighten the three hold-down screws (page 269, Figure 43, item 6).
4. Return the printer to normal operation (page 159).

Paper Ironer

CAUTION:

<2> Over time the upper edge of the paper ironer can become sharp. To avoid cutting yourself handle the paper ironer on the sides.

Removal

1. Remove the shuttle frame assembly (page 249).
2. Move the forms thickness lever to the open position.
3. Push the ends of the paper ironer toward the rear of the printer, disengage the tabs, then lift it up and out (page 283, Figure 49).

Installation

NOTE: The black tape on the paper ironer faces the paper detector switch assembly.

1. Position the paper ironer so that the black tape is on the side that faces the paper detector switch assembly. (See page 283, Figure 49.)
2. Push the paper ironer down into the slots until the tabs engage.
3. Install the shuttle frame assembly (page 249).
4. Return the printer to normal operation (page 159).

Platen

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the shuttle frame assembly (page 249).
3. Remove the paper ironer (page 236).
4. Remove the three 1/4 inch screws securing the paper ironer bracket assembly and remove the assembly. (See Figure 49, page 283, items 4 through 6.)
5. Remove the platen open belt (page 197).
6. Remove the platen pulley (page 283, Figure 49, item 21):
    a. Loosen the 7/64 inch collar clamp screw.
    b. Pull the platen pulley off the platen shaft.
7. Pull the spring link and white plastic bushing off the platen shaft and remove the spring link, bushing, and spring. (See Figure 49, page 283, items 16, 17, and 18.)
8. Remove the forms thickness lever by loosening the 7/64 inch clamp screw and pulling the lever off the platen shaft. (See Figure 49, page 283, item 15.)
9. Remove the right side platen support spring by repeating step 7 on the right side of the platen.
10. Remove the Phillips #1 screw and washer securing the forms thickness indicator plate from the inside of the right side bracket. (See Figure 49, page 283, items 9 and 10.)
11. Pull the indicator plate, with the interlock switch assembly attached, off the platen shaft.
12. Remove the two 7/32 inch screws and washers securing the right ribbon guide assembly to the side plate. (See Figure 50, page 285, item 12, 14, and 15.)
13. Slide the ribbon guide assembly out of the side plate.

14. Pull the right side of the platen toward the front of the printer and move the platen to the right and out of the left side plate. (Hold the black metal washer on the left side shaft as you remove the platen. Make sure the copper wear saddles in the platen seat of the mechanism base stay in place.)

Installation

IMPORTANT

The dowel pins protruding from the ends of the platen are the platen shafts, and are not equal in length. The platen must be installed with the longer shaft on the right side.

1. Wipe the platen shafts clean of grease and debris.
2. Install two washers on the longer (right) platen shaft. (See Figure 35.)
3. Apply bearing lubricant to both platen shafts.

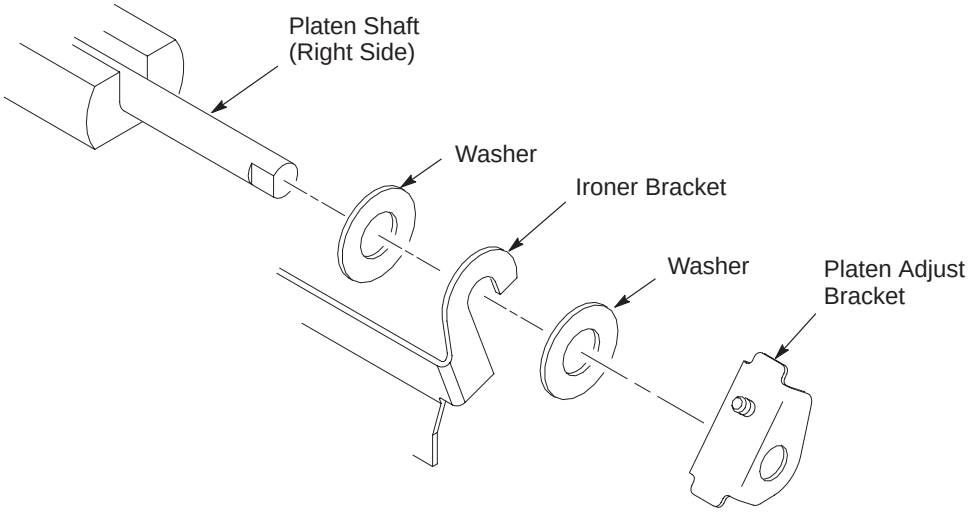


Figure 35. Installing the Platen Adjust Brackets

Platen Installation (continued)

4. Make sure the two wear saddles are set flush into the corners of the mechanism base platen seat. (See Figure 36.)

5. Apply a layer of bearing lubricant 1/4 inch high to the seat of each wear saddle, making the layer as wide as the saddle and touching the rear angled surface.

6. Install one platen adjust bracket onto the longer platen shaft, with the screw at the top of the bracket.

7. Place the other bracket onto the left side mechanism base platen seat so that the mechanism base platen seat is between the flanges of the bracket.

8. Insert the shorter platen shaft through the left adjust bracket and through the opening in the left side plate. Rotate the longer shaft into the opening in the right side plate and position the adjustment brackets as shown in Figure 36.

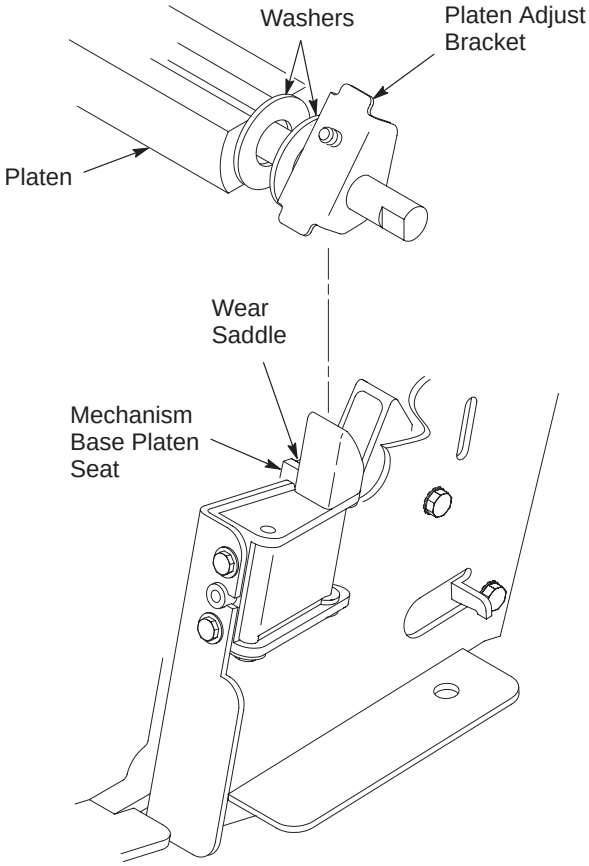


Figure 36. Installing the Platen Adjust Brackets

Platen Installation (continued)

9. Slide the right ribbon guide assembly into the side plate and install the two 7/32 inch screws and washers. (See Figure 50, page 285, item 12, 14, and 15.)

10. Install the forms thickness indicator plate:

    a. Slide the indicator plate, with the interlock switch assembly attached, onto the platen shaft and up against the right side plate.

    b. Install the Phillips #1 screw and washer securing the indicator plate.

11. Install the black metal washer onto the left side of the platen shaft. (See Figure 49, page 283, item 26.)

12. Apply bearing lubricant to the nylon bearings in the two spring links, slide the spring links onto the two platen shafts, and connect the springs to the spring hooks in the side plates. (See Figure 49 page 283, items 16, 17, and 18.)

13. Apply bearing lubricant to the two platen shafts on both sides, between the ends of the platen and the platen adjustment brackets.

14. Install the paper ironer bracket. (See Figure 35):

    a. With the flat part of the bracket facing the front of the printer, place the two hooks of the upper part of the paper ironer over the platen shafts.

       The left hook of the paper ironer goes between the left platen adjustment bracket and the platen.

       For the right side of the platen, a washer goes on both sides of the paper ironer hook and the hook goes to the left of the right platen adjustment bracket. (See Figure 35.)

    b. Install and torque three screws to 20 ± 2 inch-pounds (2.26 ± 0.23 N•m).

15. Push the platen to the left.

16. Install the forms thickness lever onto the right side platen shaft, pressing the interlock switch out of the way as the lever slides past it. Tighten the 7/64 inch setscrew. (See Figure 49, page 283.) Open and close the forms thickness lever to make sure the setscrew does not touch the right ribbon guide.

Platen Installation (continued)

17. Install the platen shaft pulley with the 7/64 inch setscrew facing up and tighten the setscrew. Open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.
18. Install, but do not adjust, the platen open belt and platen open motor pulley (page 197).
19. Install the paper ironer with the black tape towards the rear of the printer (page 236).
20. Install the shuttle frame assembly (page 249).
21. Adjust the platen gap (page 168).
22. Adjust the platen open belt (page 162).
23. Check ribbon guide alignment (page 172).
24. Check the hammer phasing (page 179).
25. Return the printer to normal operation (page 159).

Resistors, Terminating

For parallel interface configurations, the printer is equipped with 470 ohm pull-up terminating resistors and 1K ohm pull-down terminating resistors on the controller board. These are suitable for most applications. (See Figure 37, page 243.)

If the standard terminating resistor pack is not compatible with the particular interface driver requirements of the host computer, other values of pull-up and pull-down resistors may be required. 220 ohm pull-up and 330 ohm pull-down alternate terminating resistors are provided with the printer. If you install the 220 ohm pull-up resistor, you must also install the 330 ohm pull-down resistor. Possible terminating resistor combinations are shown below.

Configuration	RP1 (Pull-Up)	RP2 (Pull-Down)
Factory Default	470 Ohm	1K Ohm
Alternate 1	220 Ohm	330 Ohm
Alternate 2	1K Ohm	None

Removal

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 158).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Locate the terminating resistor packs. (See Figure 37.)
4. Using a chip puller, remove the packs.

Installation

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Using a chip installation tool, install the resistor packs in the correct socket. (See Figure 37, page 243.)
2. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).

3. Return the printer to normal operation (page 159).

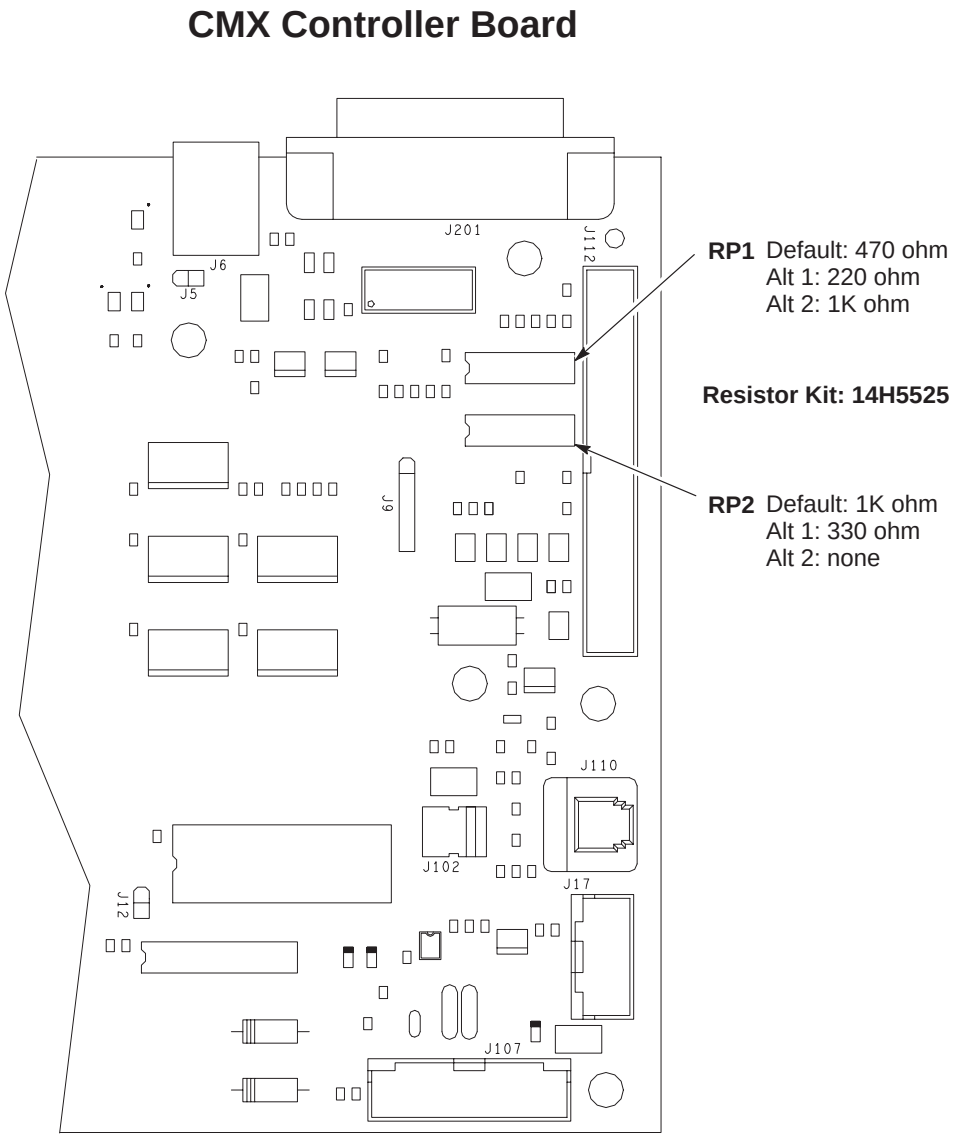


Figure 37. Resistors, Terminating, Removal/Installation

Ribbon Guide Assembly (L/R)

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Remove the printer ribbon.

NOTE: The right ribbon guide is shown in Figure 50. The removal procedure is the same for the left ribbon guide.

4. Cut and remove the tie-wrap from the tie wrap hole to free the ribbon guide cable (page 285, Figure 50).
5. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
6. Trace the ribbon guide cable back to the controller board, releasing it from the cable restraints. (See cable routing diagram on page 306.)
7. For the left ribbon guide, disconnect connector shell P106 from the controller board. For the right ribbon cable, disconnect connector shell P107 from the controller board.
8. Trace the ribbon guide wires to the connector shell, and remove the cable connector from the connector shell (page 198).
9. Remove the two screws and washers securing the ribbon guide assembly to the side plate.
10. Slide the ribbon guide assembly out of the side plate.

Installation

NOTE: The right ribbon guide is shown in Figure 50. The installation procedure is the same for the left ribbon guide.

1. Reverse steps 4 through 10 of the removal procedure above.
2. Align the ribbon guides (page 172).
3. Return the printer to normal operation (page 159).

Ribbon Hub

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the printer ribbon.
3. Loosen the Torx T-10 screw in the ribbon spool hub (page 285, Figure 50).
4. Remove the hub from the shaft of the ribbon drive motor.

Installation

1. Install the ribbon spool hub over the motor shaft (page 285, Figure 50).
2. Tighten the hub screw so that it contacts the flat section of the motor shaft.
3. Return the printer to normal operation (page 159).

Shaft, Splined

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Remove the paper supports from the splined shaft and support shaft. (See Figure 48, page 281, item 21.)
4. Remove the paper feed timing belt (page 195).
5. Remove the ground clip (page 281, Figure 48).
6. With grip ring pliers, remove the grip ring from left side of the splined shaft.
7. Pull the bearing and spring link with the spring off the left side of the splined shaft.
8. Unlock the left and right tractors and slide them to the center of the shaft.
9. Remove the bearing clamp on the right side of the splined shaft.
10. Hold the tractors so they do not fall, grasp the vertical adjustment knob, and slide the splined shaft to the right out of the side plates and the tractors.

Installation

1. Open the doors on the left and right tractors. Position the tractor belts so the alignment marks are at the top on both tractors. (See Figure 38.)
2. Grasp the vertical adjustment knob and slide the splined shaft through the right side plate, the tractors, and the left side plate (page 281, Figure 48). Make sure the same spline passes the marked groove on each tractor.
3. Install the bearing clamp and screw.
4. Apply a thin film of bearing lubricant to the bearing.
5. Slide the spring link and bearing onto the left side of the splined shaft with the white nylon bushing flange to the outside of the printer.
6. Attach the spring to the left side plate and the spring link.
7. Install the grip ring on the splined shaft with 0.010 inches of clearance between the grip ring and the nylon bearing.
8. Install the ground clip and screw.
9. Install the paper feed timing belt (page 195).
10. Set the paper feed timing belt tension (page 160).
11. Adjust splined shaft skew (page 174.)
12. Install the paper supports on the splined shaft and support shaft. (See Figure 48, page 281, item 21.)
13. Return the printer to normal operation (page 159).

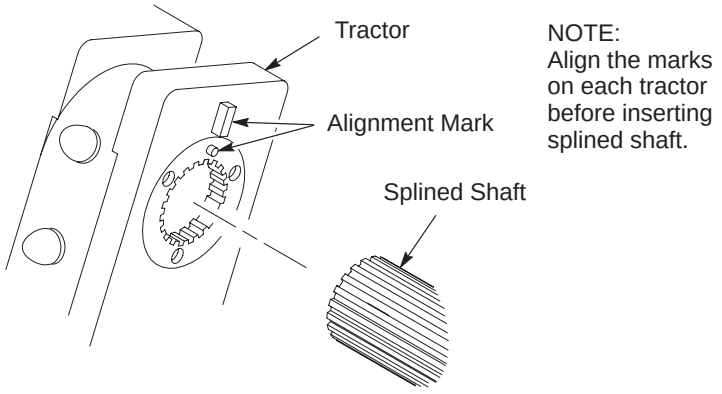


Figure 38. Splined Shaft and Tractor Installation

Shaft, Support

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Unlock the tractors and slide them to the far right.
4. Remove the paper supports from the splined shaft and support shaft. (See Figure 48, page 281, item 21.)
5. Remove the E-ring (page 281, Figure 48).

ATTENTION

Hold the tractors while removing the support shaft, and be careful not to lose the curved spring washers. (See Figure 48, page 281, item 5.)

6. Slide the support shaft assembly—consisting of the support shaft, two curved washers, bushing, horizontal adjustment knob, washer and screw—to the left, out of the tractors and the left side plate.

Installation

1. Slide the support shaft assembly—consisting of the support shaft, two curved washers, bushing, horizontal adjustment knob, washer, and screw—into the left side plate. (See page 281, Figure 48.)
2. Slide the tractors onto the support shaft.
3. Slide the support shaft assembly through the right side plate.
4. While pushing on the knob to compress the curved washers, install the E-ring in the groove on the bushing.
5. Install the paper supports on the splined shaft and support shaft. (See Figure 48, page 281, item 21.)
6. Return the printer to normal operation (page 159).

Shuttle Frame Assembly

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the shuttle cover assembly (page 209).
3. Disconnect the MPU cable connector (page 279, Figure 47).

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

4. Disconnect the shuttle motor cable connector (page 275, Figure 45).
5. Disconnect the hammer drive and hammer logic cables connectors from the terminator board on the shuttle frame assembly.
6. Loosen the side 5/32 inch socket head clamp screws and pull the clamps back and off the guide shaft. Do not remove the clamps.
7. Loosen the center 5/32 inch socket head screw enough to release the shuttle frame assembly from the base casting.
8. Unlock and slide the tractors outward as far as they will go on the tractor support shaft.
9. Grasping the support legs cast on both sides of the shuttle motor, lift the shuttle frame assembly out of the base casting. Lift it slowly and carefully: the shuttle frame assembly is heavy.

Installation

1. Install the hammer bank / ribbon mask cover assembly (page 206), if it was removed.

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

Do not remove the grease from the shaft of the replacement shuttle frame assembly. The shuttle shaft is aluminum, and the clamped ends of the shaft must be greased to prevent galling.

2. Holding the shuttle frame assembly by the support legs cast on both sides of the shuttle motor, set it into the base casting. **Use both hands**: the shuttle frame assembly is heavy (page 275, Figure 45).

3. Align the center 5/32 inch socket head screw in the base casting and hand turn the screw until only two or three threads have started.

4. Pull the shuttle frame assembly toward the front of the printer and hold it in this position while you do step 5.

IMPORTANT

Do not over tighten the shuttle frame assembly hold-down screws.

5. Slide the side clamps over the guide shaft and torque the 5/32 inch socket head clamp screws to 20 ± 2 inch-pounds (2.26 ± 0.23 N•m).

6. Torque the center captive 5/32 inch socket head screw to 20 ± 2 inch-pounds (2.26 ± 0.23 N•m).

7. Connect the hammer drive and hammer logic cable connectors to the terminator board on the shuttle frame assembly.

8. Connect the shuttle motor cable connector.

9. Route the MPU cable under the extension spring and connect the MPU cable connector. (See Figure 47, page 279, item 4.) Make sure the MPU cable does not touch the extension spring after it is connected.

10. If the shuttle frame assembly is a new or refurbished unit, adjust the platen gap (page 168); otherwise, skip to step 11.

11. Install the shuttle cover assembly (page 209).

12. Models –014 and –015 only: adjust the coil temperature if the original shuttle frame assembly was replaced (page 188).

13. Models –004, –04P, –005, and –05P only: set shuttle speed if the original shuttle frame assembly was replaced (page 189).

14. Adjust the hammer phasing (page 179).

15. Return the printer to normal operation (page 159).

Spring Assembly, Gas

NOTE: This procedure applies only to cabinet models.

Removal

CAUTION:

<3> Two persons may be required to perform this procedure. Prop or hold the top cover securely open while disengaging the gas spring assembly.

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Open the floor cabinet rear door.
4. Pry back the spring retaining clips (page 265, Figure 41).
5. Remove the gas spring assembly from the ball studs.

Installation

ATTENTION

The gas spring assembly must be installed with gas cylinder in the up position.

1. Position the gas spring assembly against the ball studs on the upper and lower brackets (page 265, Figure 41). The large cylinder must be uppermost.
2. Push the gas spring assembly onto the ball joints and install the spring clips.
3. Close the printer cover. If necessary, adjust the position of the ball joint stud in the lower bracket to achieve smooth and complete closure.
4. Return the printer to normal operation (page 159).

Spring, Extension

ATTENTION

Do not let the hammer bank rotate toward the platen during spring replacement.

Removal

1. Prepare the printer for maintenance (page 194).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 209).
4. Unhook the extension spring from the spring lugs on the hammer bank and shuttle frame. (See Figure 47, page 279.)

Installation

1. Put a dab of IBM #20 bearing lubricant on both spring lugs.

ATTENTION

Make sure the extension spring does not touch the MPU cable after installation.

2. Hook the extension spring over the spring lugs. (See Figure 47, page 279.)
3. Install the shuttle cover assembly (page 209).
4. Return the printer to normal operation (page 159).

Switch Assembly, Cover Open

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the shuttle cover assembly (page 209).
3. Carefully lift and pry the cover open switch assembly out its well in the base casting to the right of the shuttle motor. (See Figure 45, page 275.)
4. Trace the cover open switch cable back to the controller board, releasing the cable from the restraints under the base casting. (See cable routing diagram on page 306.)
5. Disconnect connector shell P107 (P7) from the controller board.
6. Trace the ribbon motor wires to the connector shell, and remove the cable connector from the connector shell (page 198).

Installation

1. Remove the protective covering from the adhesive backing on the cover open switch assembly.
2. Feed the switch cable down into the cover open switch well to the right of the shuttle motor. Position the cover open switch assembly in the base casting and press it into place.
3. Route the cover open switch cable back to the controller board, installing the cable in the restraints under the base casting. (See cable routing diagram on page 306.)
4. Connect the cover open cable to the connector shell (page 198), then connect the connector shell P107 (P7) to the controller board.
5. Install the shuttle cover assembly (page 209).
6. Return the printer to normal operation (page 159).

Switch Assembly, Paper Detector

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Cabinet Model: Loosen four screws and remove the barrier shield. (See page 269, Figure 43, items 3, 4, and 9.)
   Pedestal Model: Remove the paper guide, barrier shield, and four screws. (See page 271, Figure 44, items 3, 4, and 5.)
4. Remove the two screws securing the paper detector switch assembly. (See Figure 50, page 285.)
5. Trace the paper detector switch cables back to the controller board, releasing the cables from the restraints under the base casting. (See cable routing diagram on page 306.)
6. Disconnect connector shell P106 from the controller board.
7. Remove switch cable connectors PMD and POD from connector P106 (page 198).
8. Remove the paper detector switch assembly.

Installation

1. Holding the slotted wheel against the PMD sensor, position the paper detector switch assembly and install the screws securing it to the printer base. (See Figure 50, page 285.)

2. Check the PMD sensor arm range: make sure it travels freely and completely back into the sensing cavity.

3. Route switch cables PMD and POD back to the controller board, installing the cables in the restraints under the base casting. (See cable routing diagram on page 306.)

4. Connect switch cables PMD and POD to the connector P106 (page 198), then connect P106 to controller board connector J106.

5. Cabinet Model: Install the barrier shield and tighten the four screws. (See page 269, Figure 43, items 3, 4, and 9.)
   Pedestal Model: Install the paper guide, barrier shield, and four screws. (See page 271, Figure 44, items 3, 4, and 5.)

6. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).

7. Check and adjust the End of Forms Distance (page 175).

8. Return the printer to normal operation (page 159).

Switch Assembly, Platen Interlock

Removal

1. Prepare the printer for maintenance (page 194).
2. Cabinet Model: Remove the paper guide assembly (page 235).
   Pedestal Model: Remove the top cover assembly (page 210).
3. Fully close the forms thickness lever (position ‘A’).
4. Trace the platen interlock switch cable back to the controller board. Remove tie-wraps as necessary to free the cable. (See cable routing diagram on page 306.)
5. Disconnect connector shell P107 (P7) from the controller board.
6. Remove the platen interlock cable connector from the connector shell (page 198).
7. Remove two screws securing the platen interlock switch assembly. (See Figure 49, page 283.)
8. Remove the platen interlock switch assembly from the switch bracket.
9. Remove the switch cable from the cutout in the right side plate.

Installation

1. Fully close the forms thickness lever (position ‘A’).
2. Position the platen interlock switch assembly on the switch bracket and install the two screws securing it to the bracket. (See Figure 49, page 283.)
3. Route the switch cable through the cutout in the right side plate and to the controller board. (See cable routing diagram on page 306.)
4. Connect the platen interlock switch cable to the connector shell P107 (P7) (see page 198), then connect the connector shell to the controller board.
5. Cabinet Model: Install the paper guide assembly (page 235).
   Pedestal Model: Install the top cover assembly (page 210).
6. Return the printer to normal operation (page 159).

Tractor (L/R)

Removal

1. Prepare the printer for maintenance (page 194).
2. Remove the splined shaft (page 246).
3. Remove the support shaft (page 248).
4. Remove the tractors.

Installation

1. Using the replacement tractors, install the support shaft (page 248).
2. Install the splined shaft (page 247).
3. Return the printer to normal operation (page 159).

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Item No.	Part No. (Order No.)	Description	Notes
1	24H8961	Top Cover Kit	Includes mounting hardware
2	57G1492	Window, Top Cover	Not visible in Figure 39
3	14H5567	Wireform Paper Guide Assembly	Includes mounting hardware
4	24H8960	Rear Door Kit	Includes mounting hardware (Not visible in Figure 39)
5	24H8959	Front Door Kit	Includes mounting hardware
6	57G1485	Caster, with Brake	Two at front
7	57G1486	Caster, without Brake	Two at rear
8	14H5603	Logo, 6400	
9	30H4008	Wire Rope, Front and Rear	One on each door (Rear not shown in Figure 39)
10	30H3986	Shipping Container Kit	Cabinet models only Not shown in Figure 39
11	14H5572	Hardware Kit	Not shown in Figure 39
12	63H7510	Door Seal Kit	
13	63H7398	Top Cover Seal Kit	

NOTE:
Item 10: Shipping Container Kit not shown
Item 11: Hardware Kit not shown

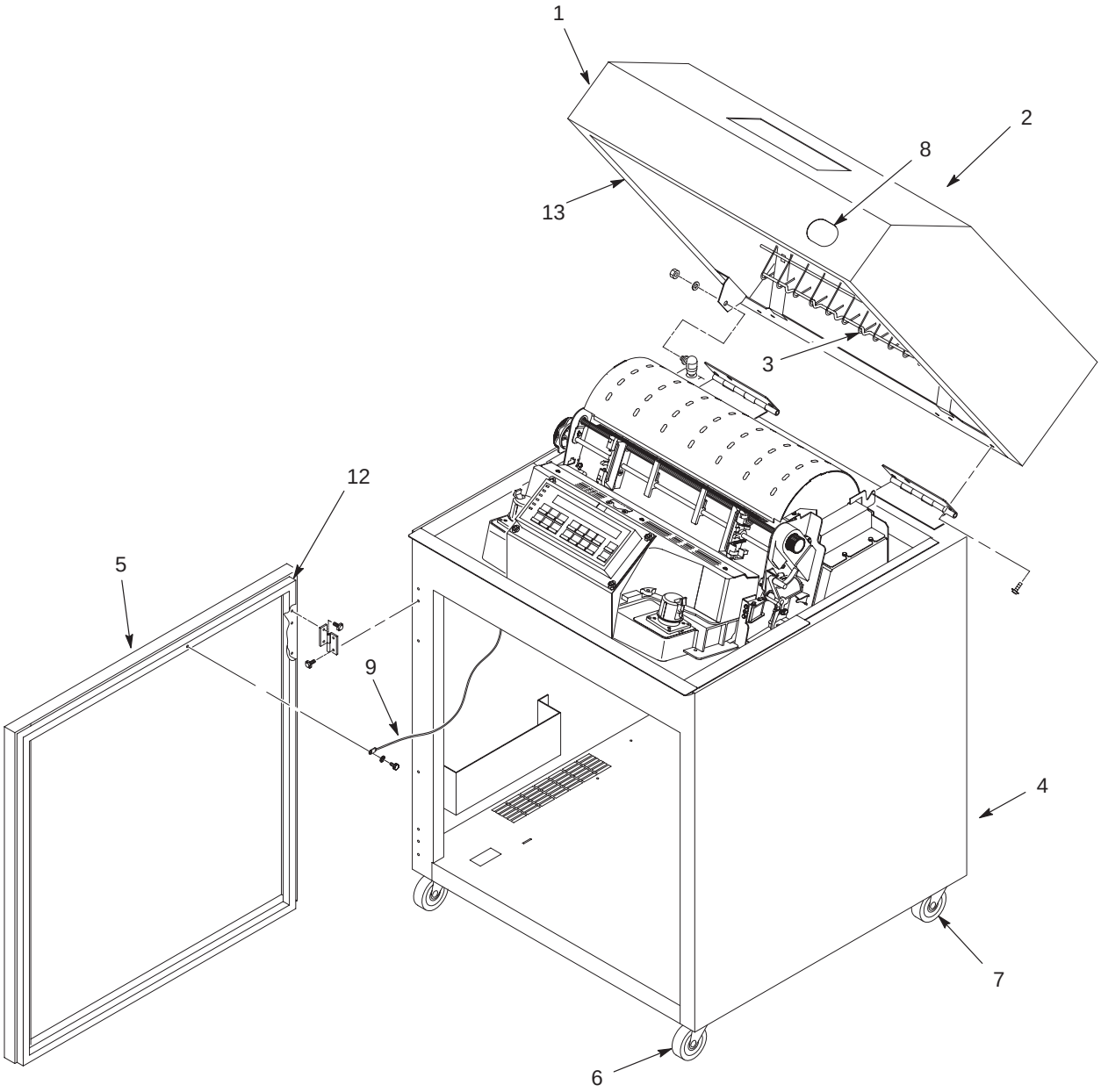

Figure 39. Top Cover, Doors, and Casters, Cabinet Model

Item No.	Part No. (Order No.)	Description	Notes
1	57G7176	Stacker	
2	30H3981	Runner, Stacker	
3	04H4779	Riser, Stacker Runner	
4	Ref	Screw (4)	
5	14H5296	Spares Kit, Grommet	
6	14H5272	Chain Assembly Kit	Kit contains eight chains
7	57G7260	Power Cord, U.S.	
9	Ref	Grommet, Power Cord (2)	Included in item 5

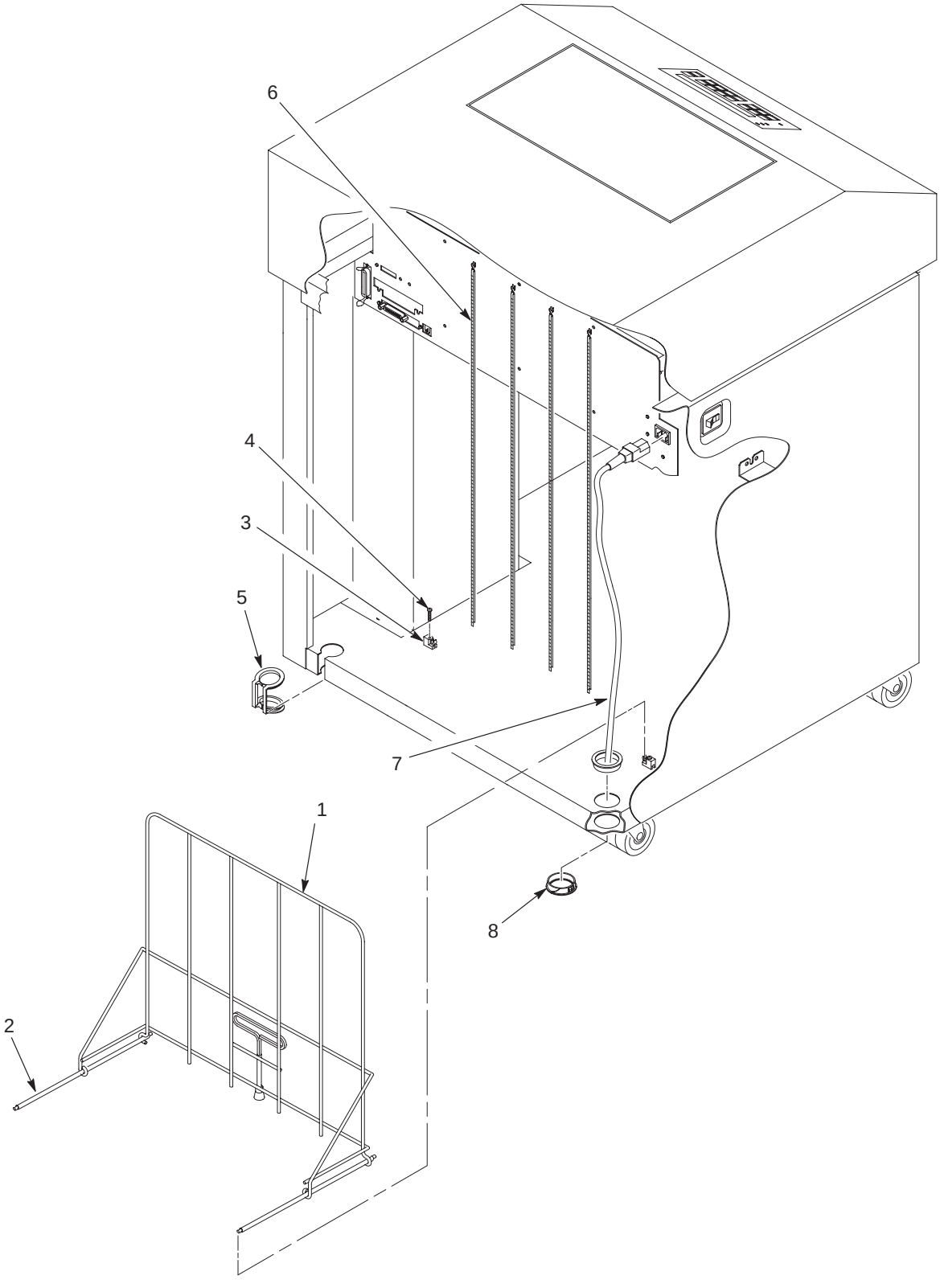

Figure 40. Paper Stacker and Chains

Item No.	Part No. (Order No.)	Description	Notes
1	14H5299	Operator Panel, Cabinet	Includes mounting hardware
2	57G1598 57G1599 57G1600 57G1601 57G1602 57G1603 57G1604	Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay	English Spanish French Italian German Dutch Brazilian Portuguese
3	Ref	Screw, Hex w/Lock Washer (4)	6–32x.375
4	14H5300	Cable Assy, Operator Panel	
5	57G1481	Gas Spring Kit	Includes ball studs, spring clips, and mounting hardware
6	Ref	Screw w/Lock Washer (3)	6–32x.375
7	Ref	Screw w/Lock Washer (2)	6–32x.175
8	57G1440	Fan Assembly	
9	Ref	Duct, Air Exhaust	

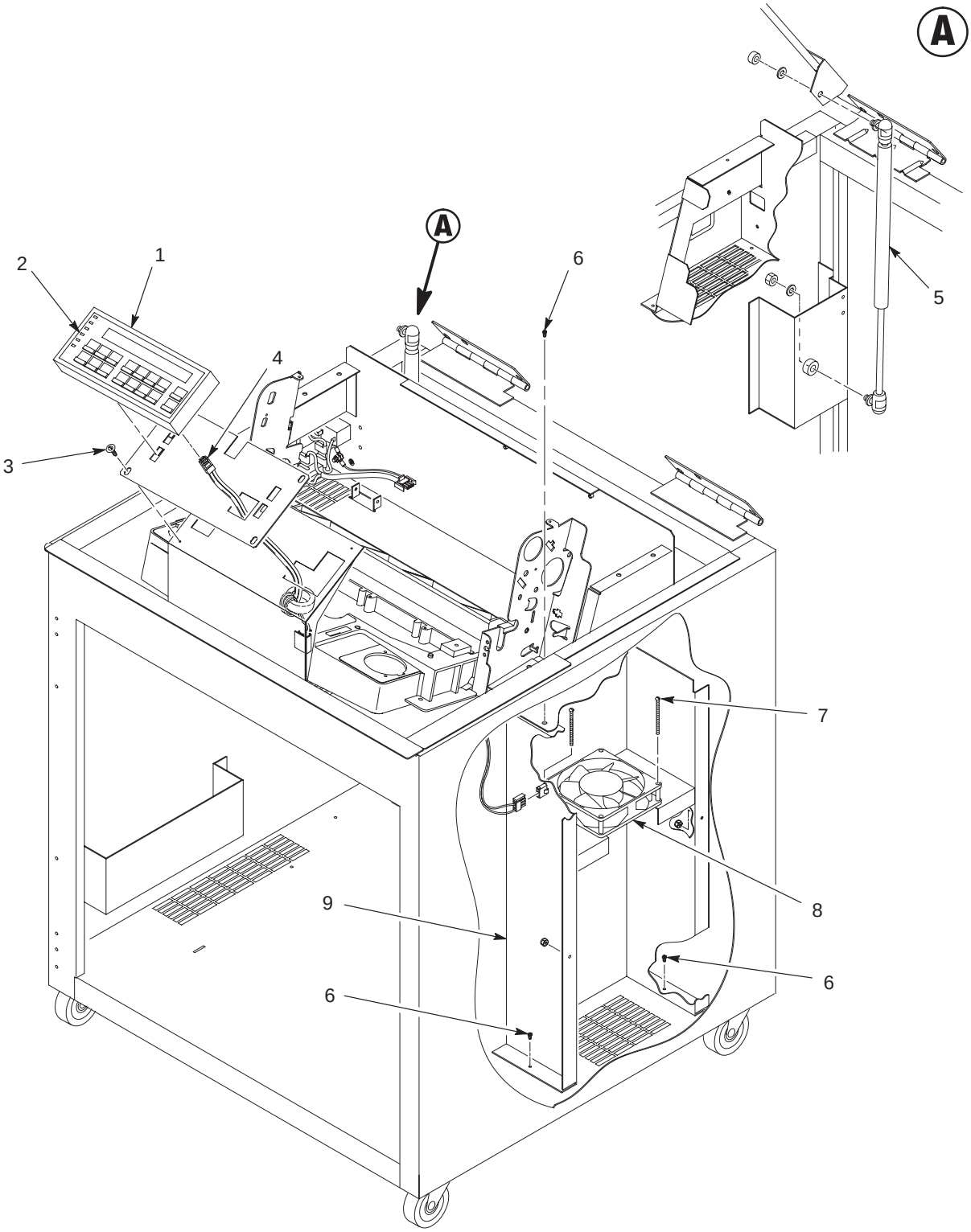

Figure 41. Control Panel and Cabinet Details

Item No.	Part No. (Order No.)	Description	Notes
1	63H5124	Operator Panel, Pedestal	Models 04P, 05P, 08P, 09P
2	57G1598 57G1599 57G1600 57G1601 57G1602 57G1603 57G1604	Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay Operator Panel Overlay	English Spanish French Italian German Dutch Brazilian Portuguese
3	Ref	Screw (5)	6–32x.50
4	63H5125	Bracket, Control Panel	Models 04P, 05P, 08P, 09P
5	63H5121	Hinge Lid Kit	Models 04P, 05P, 08P, 09P
6	14H5300	Cable Assy, Control Panel	
7	63H5119	Lid, Pedestal Model	Models 04P, 05P, 08P, 09P
8	Ref	Screw (2)	
9	63H5120	Top Cover	Models 04P, 05P, 08P, 09P
10	Ref	Screw (4)	10–32x.625
11	63H5118	Paper Basket	Models 04P, 05P, 08P, 09P
12	63H7509	Caster, Pedestal	Models 04P, 05P, 08P, 09P
13	63H5117	Pedestal Kit	Models 04P, 05P, 08P, 09P
14	Ref	Screw, Captive (2)	
15	24H8533	Input Tray	Optional item on models 04P, 05P, 08P, 09P
16	63H5122	Lid Accessory Kit	Replacement acoustic seals (Not shown in Figure 42)
17	64H5123	Shipping Container, Pedestal	Models 04P, 05P, 08P, 09P (Not shown in Figure 42)

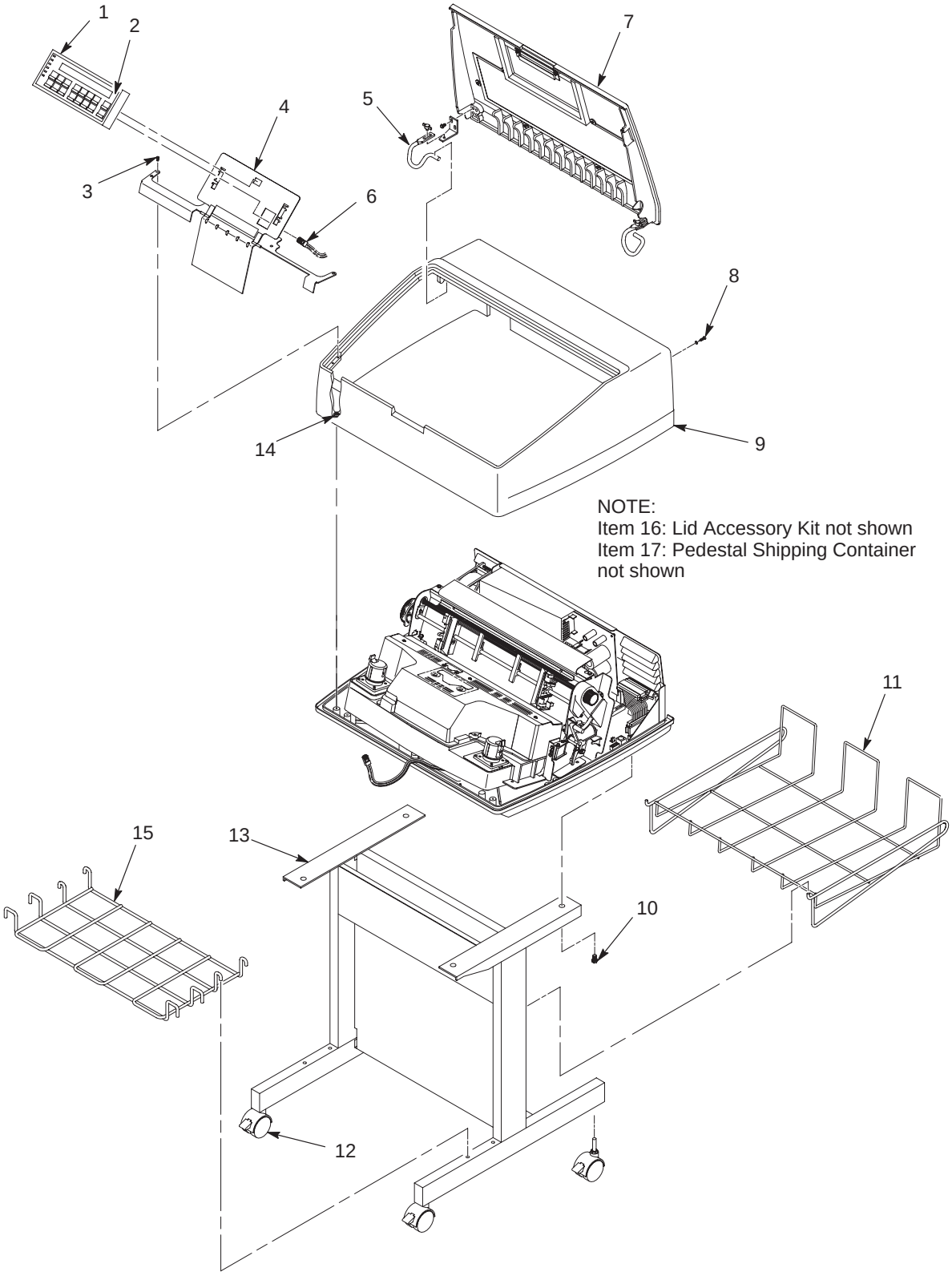

Figure 42. Pedestal Details

Item No.	Part No. (Order No.)	Description	Notes
1	14H5235	Shroud Assembly, Air	Shuttle Cover Assembly
2	Ref	Screw, Captive (2)	10–24x.62 with O-ring, .125x.250x.06
3	Ref	Screw, Thread Forming (4)	6–32x.25
4	Ref	Barrier Shield	
5	14H5271	Paper Guide Assembly	Models 004, 005, 008, 009, 012, 014
6	Ref	Screw, w/Lock Washer (3)	6–32x.25 and #6 Flat Washer
7	14H5174	Platen/Paper Feed Cover Kit	Paper feed belt cover shown in Figure 43. Platen open belt cover: item 24, page 283.
8	57G1468	Belt, Timing, 050P, 100 Teeth	Paper Feed Belt
9	08H7954	Anti-Static Brush Kit	
10	Ref	Power Supply Shield	Taped to card cage along upper edge
11	14H5179	Paper Scale	

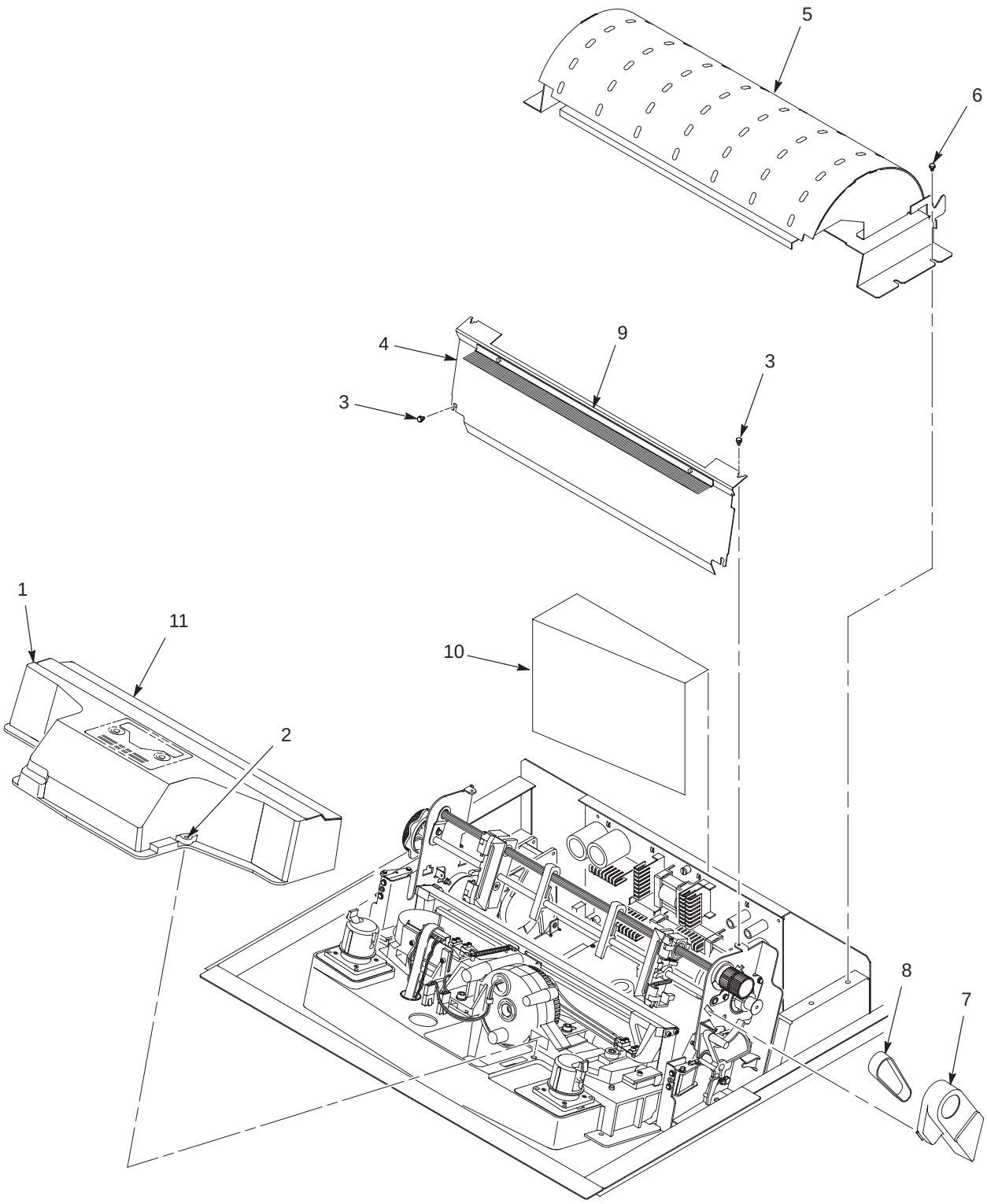

Figure 43. Inside Covers, Cabinet Model

Item No.	Part No. (Order No.)	Description	Notes
1	14H5235	Shroud Assembly, Air	Shuttle Cover Assembly
2	Ref	Screw, Captive (2)	10–24x.62 with O-ring, .125x.250x.06
3	Ref	Screw, Thread Forming (4)	6–32x.25
4	Ref	Barrier Shield	
5	63H5116	Paper Path Assembly	Models 04P, 05P, 08P, 09P
6	08H7954	Anti-Static Brush Kit	
7	Ref	Power Supply Shield	Taped to card cage along upper edge
8	57G1468	Belt, Timing, 050P, 100 Teeth	Paper Feed Belt
9	14H5174	Platen/Paper Feed Cover Kit	Paper feed belt cover shown in Figure 43. Platen open belt cover: item 24, page 283.
10	14H5179	Paper Scale	

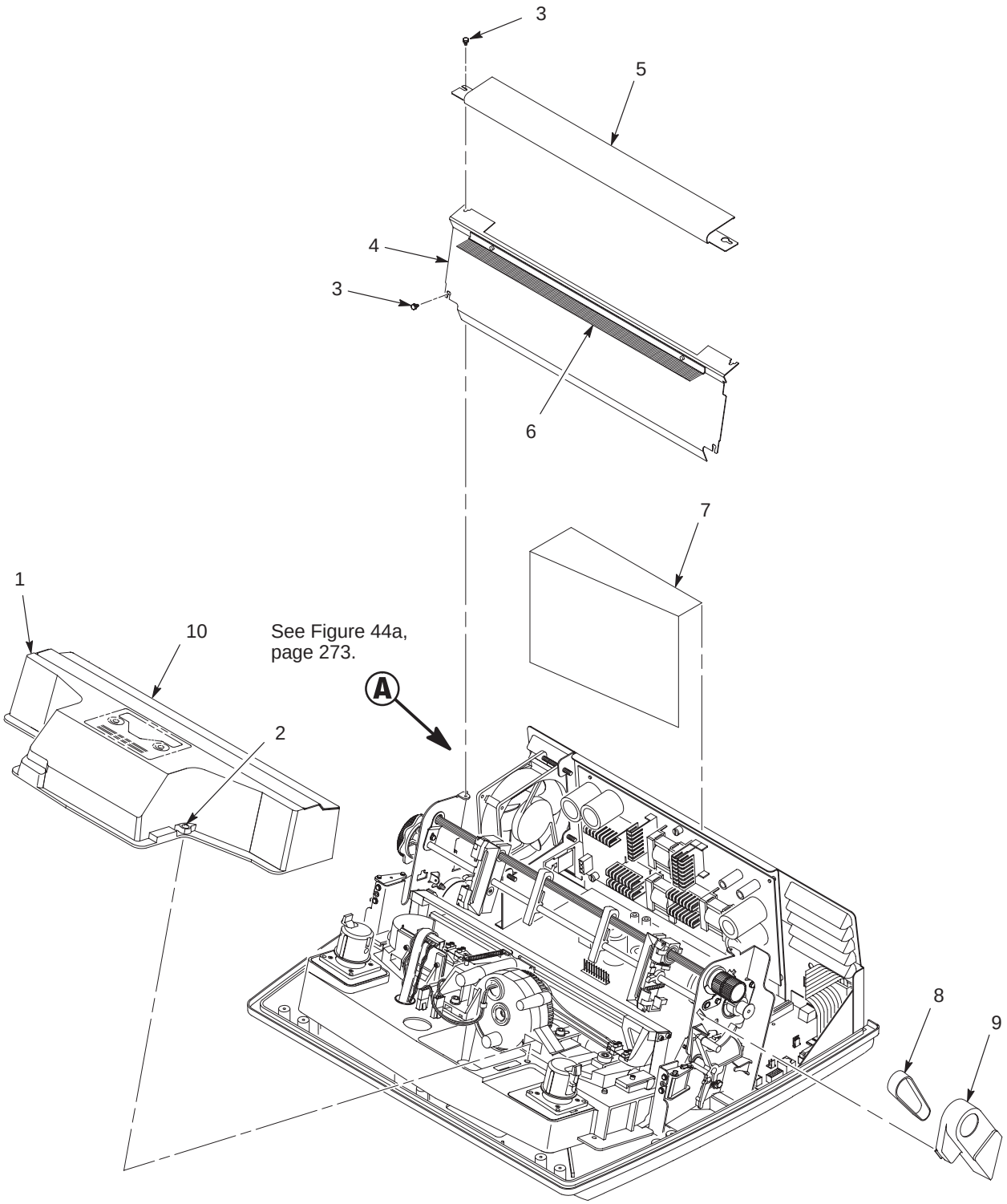

Figure 44. Inside Covers and Card Cage, Pedestal Model

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	Nut, 6–32 (1)	Upper right fan corner only
2	57G1440	Card Cage Fan Assembly	Air flow is into card cage
3	Ref	Fan Guard	
4	Ref	Screw, w/Lock Washer (4)	6–32x.1.75
5	Ref	Card Cage, Pedestal	
6	14H5571	Circuit Breaker	

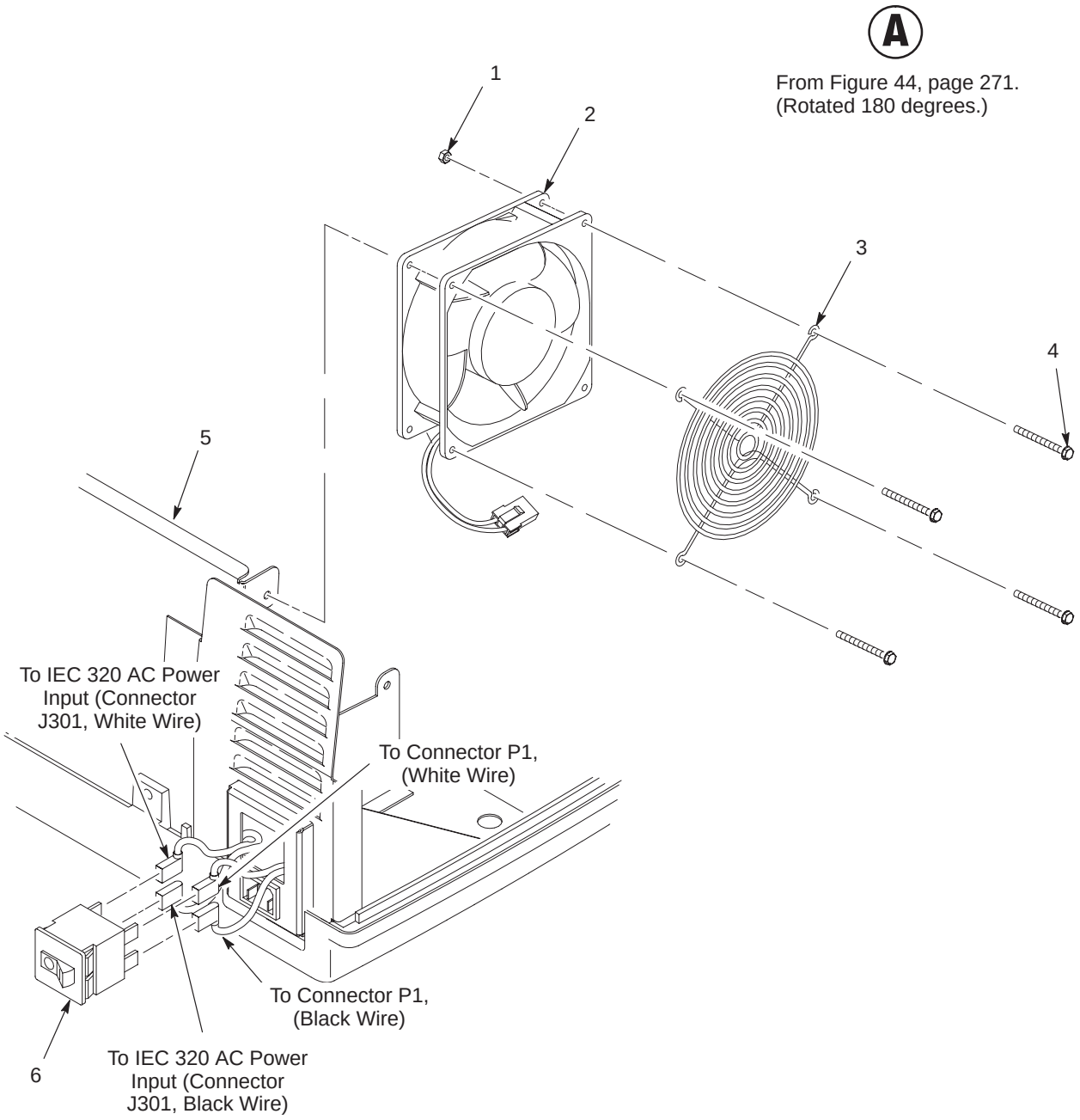

Figure 44a. Card Cage Detail, Pedestal Model

Item No.	Part No. (Order No.)	Description	Notes
1	63H7518	Hammer Bank/Rbn Mask Cover	Models 004, 04P, 005, 05P
	63H7519	Hammer Bank/Rbn Mask Cover	Models 008, 08P, 009, 09P
	63H7520	Hammer Bank/Rbn Mask Cover	Models 012, 014
2	14H5274	Shuttle Frame Assembly	Models 004, 04P
	24H8648	Shuttle Frame Assembly	Models 005, 05P
	14H5516	Shuttle Frame Assembly	Models 008, 08P
	24H9625	Shuttle Frame Assembly	Models 009, 09P
	14H5517	Shuttle Frame Assembly	Model 012
	90H3269	Shuttle Frame Assembly	Model 014
		Hammer Spring Assemblies:	
	14H5275	Hammer Spring Assembly	Models 004, 04P, 005, 05P
	14H5512	Hammer Spring Assembly	Models 008, 08P, 009, 09P
	14H5513	Hammer Spring Assembly	Models 012, 014
3	14H5644	Power Supply PCBA	Models 004, 04P, 005, 05P, 008, 08P, 012
	90H3268	Power Supply PCBA	Models 009, 09P, 014
4	Ref	P101 Cable Connector	
5	Ref	Cable Assy, AC In, Power Supply	Part of Field Kit, AC Assy 14H5289
6	14H5643	Controller Board, CMX, V5.0	All models 004 and 04P. Models 008 and 012 with Ser. Nos. 01AXXXX, 01BXXXX and 01CXXXX
	24H8647	Controller Board, CMX, V5.5, 25 MHz	All models 005, 05P, and 08P. Models 008 and 012 with Ser. Nos.01DXXXX, 01EXXX, and higher. All models 009, 09P.
	90H3271	Controller Board, CMX, V5.5, 40 MHz	Model 014, 050, P50, 010, P10, 015
7	Ref	Motor Sensor, Left, Cable Assy	Housing Connector Kit 14H5288
8	Ref	Hammer Bank Logic Cable Assy	
9	Ref	Shuttle Motor Cable Assy	
10	Ref	Hammer Bank Power Cable Assy	
11	Ref	Motor Sensor, Right, Cable Assy	Housing Connector Kit 14H5288
12	14H5287	Centronics I/O Cable Assy	
	14H5522	Centronics/Dataproducts Adapter	Optional cable assembly
13	Ref	Control Panel Cable Assy	
14	14H5211	Clamp, Shaft, Receiving	
15	Ref	Screw, Captive, Power Supply (3)	
16	Ref	SIMM, Flash Memory	See also page 224
17	Ref	SIMM, DRAM	See also page 224
18	14H5282	Switch Assembly, Cover Open	

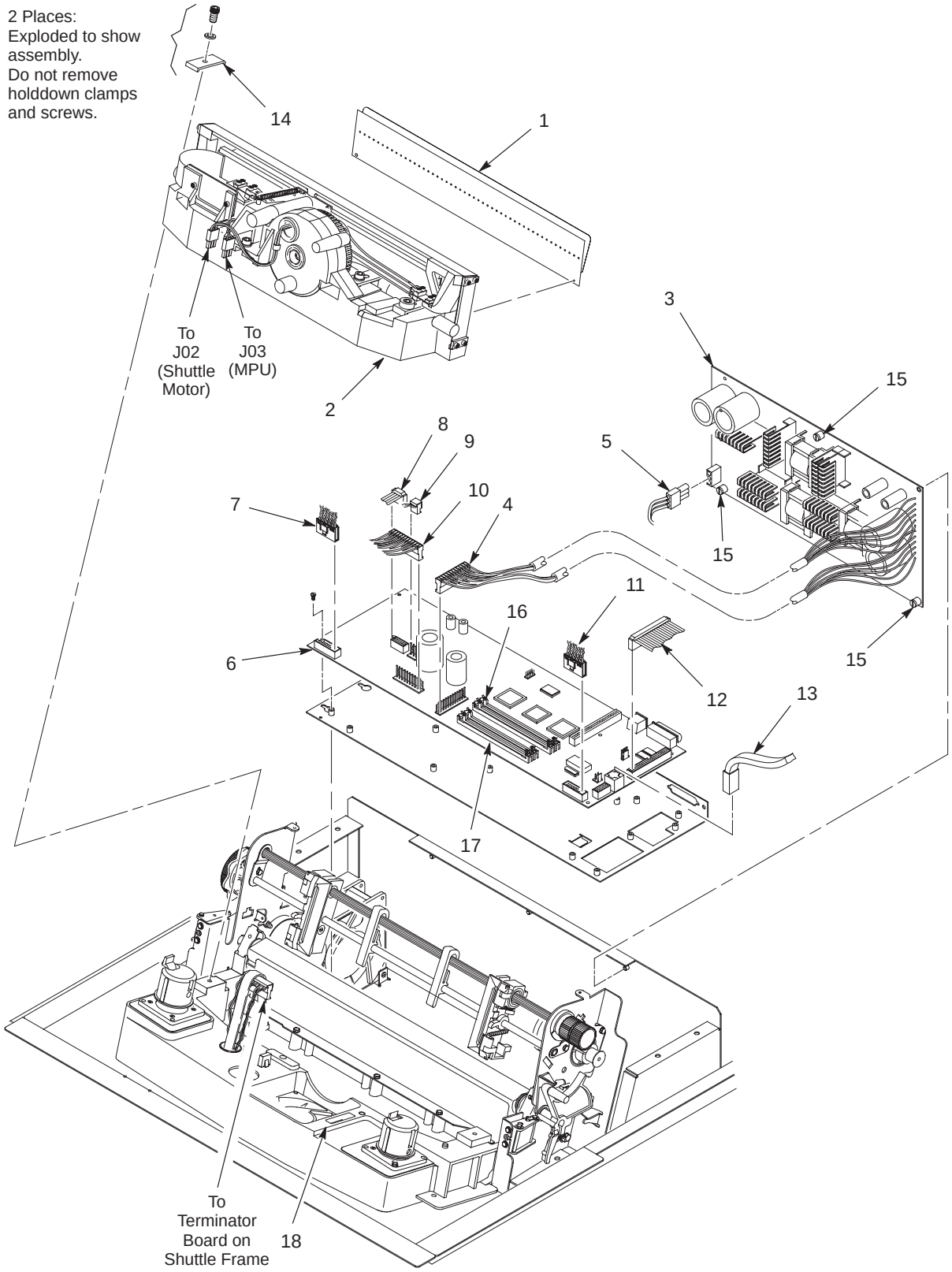

Figure 45. Print Mechanism and Circuit Boards: Early Models

Item No.	Part No. (Order No.)	Description	Notes
1	24H8872 24H8886 24H8924	Hammer Bank Cover Assy, 500 Hammer Bank Cover Assy, 1000 Hammer Bank Cover Assy, 1500	Models 050, P50 Models 010, P10 Model 015
2	24H8828 24H8844 24H8858	Ribbon Mask, 500 Ribbon Mask, 1000 Ribbon Mask, 1500	Models 050, P50 Models 010, P10 Model 015
3	Ref	Ribbon Mask Clamp Plate (3)	
4	Ref	Screw, Torx T-10 (18)	12 for hammer bank cover 6 for ribbon mask
5	24H8925 24H8927 24H8929 24H8931 24H8932 24H8933	Shuttle Frame Assembly, 500 Shuttle Frame Assembly, 1000 Shuttle Frame Assembly, 1500 Hammer Spring Field Kit, 500 Hammer Spring Field Kit, 1000 Hammer Spring Field Kit, 1500	Models 050, P50 Models 010, P10 Model 015 Models 050, P50 Models 010, P10 Model 015
6	90H3268	Power Supply PCBA	
7	Ref	P101 Cable Connector	
8	Ref	Cable Assy, AC In, Power Supply	Part of Field Kit AC Assy 14H5289
9	90H3271	Controller Board, CMX, V5.5, 40 MHz	Models 050, P50, 010, P10, 014, 015
10	Ref	Motor Sensor, Left, Cable Assembly	Housing Connector Kit 14H5288
11	Ref	Hammer Bank Logic Cable Assembly	
12	Ref	Shuttle Motor Cable Assembly	
13	Ref	Hammer Bank Power Cable Assy	
14	Ref	Motor Sensor, Right, Cable Assembly	Housing Connector Kit 14H5288
15	14H5287 14H5522	Centronics I/O Cable Assembly Centronics/Dataproducts Adapter	 Optional cable assembly
16	Ref	Control Panel Cable Assembly	
17	14H5211	Clamp, Shaft, Receiving	
18	Ref	Screw, Captive, Power Supply (3)	
19	Ref	SIMM, Flash Memory	See also page 224
20	Ref	SIMM, DRAM	See also page 224
21	14H5282	Switch Assembly, Cover Open	

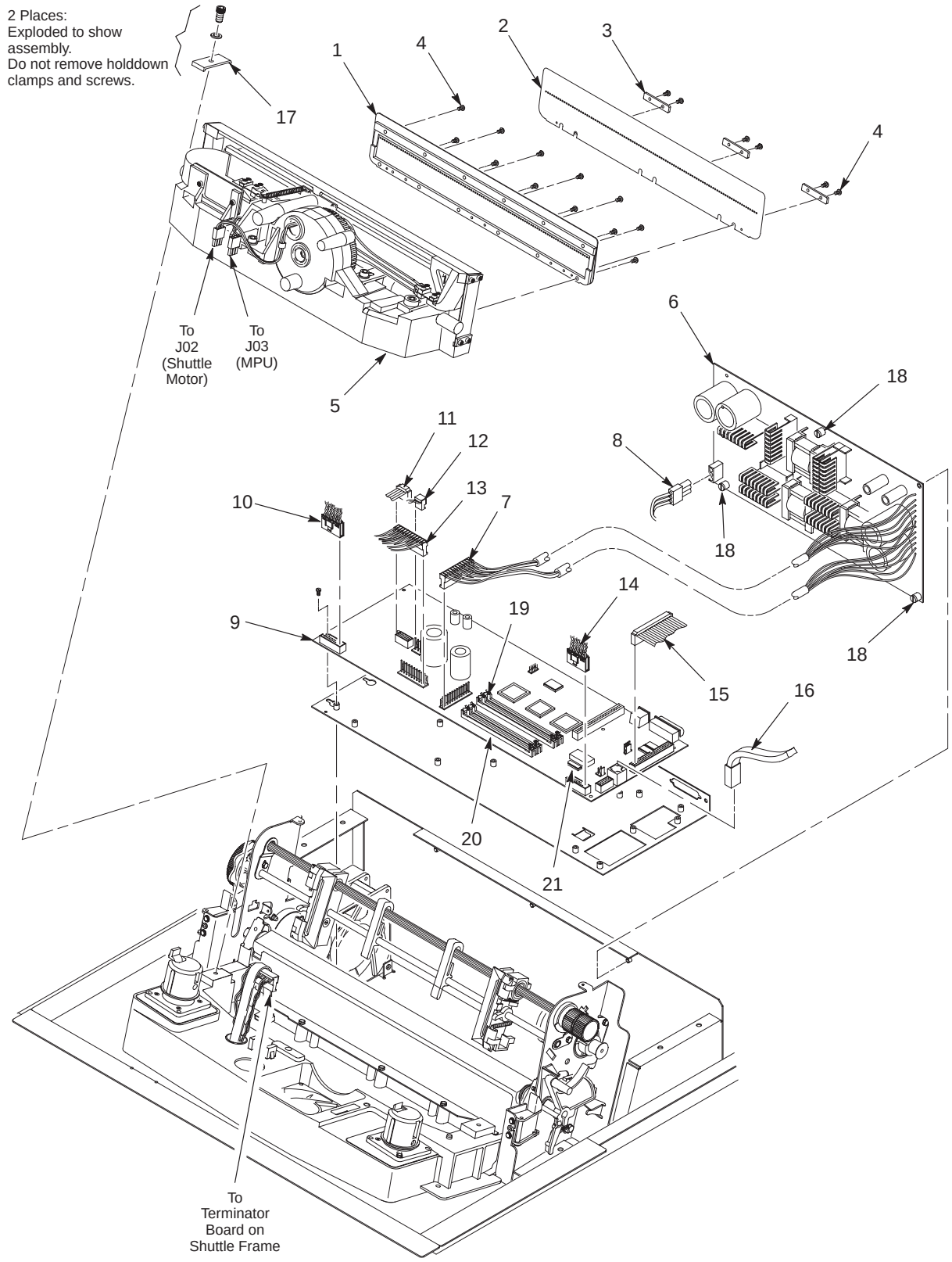

Figure 46. Print Mechanism and Circuit Boards: Later Models

Item No.	Part No. (Order No.)	Description	Notes
1	57G1476	Magnetic Pickup Assy (MPU)	
2	Ref	Screw, Socket Cap, 6–32x.38	
3	30H3985	Extension Spring	
4	14H5329	Cable Assembly, MPU	

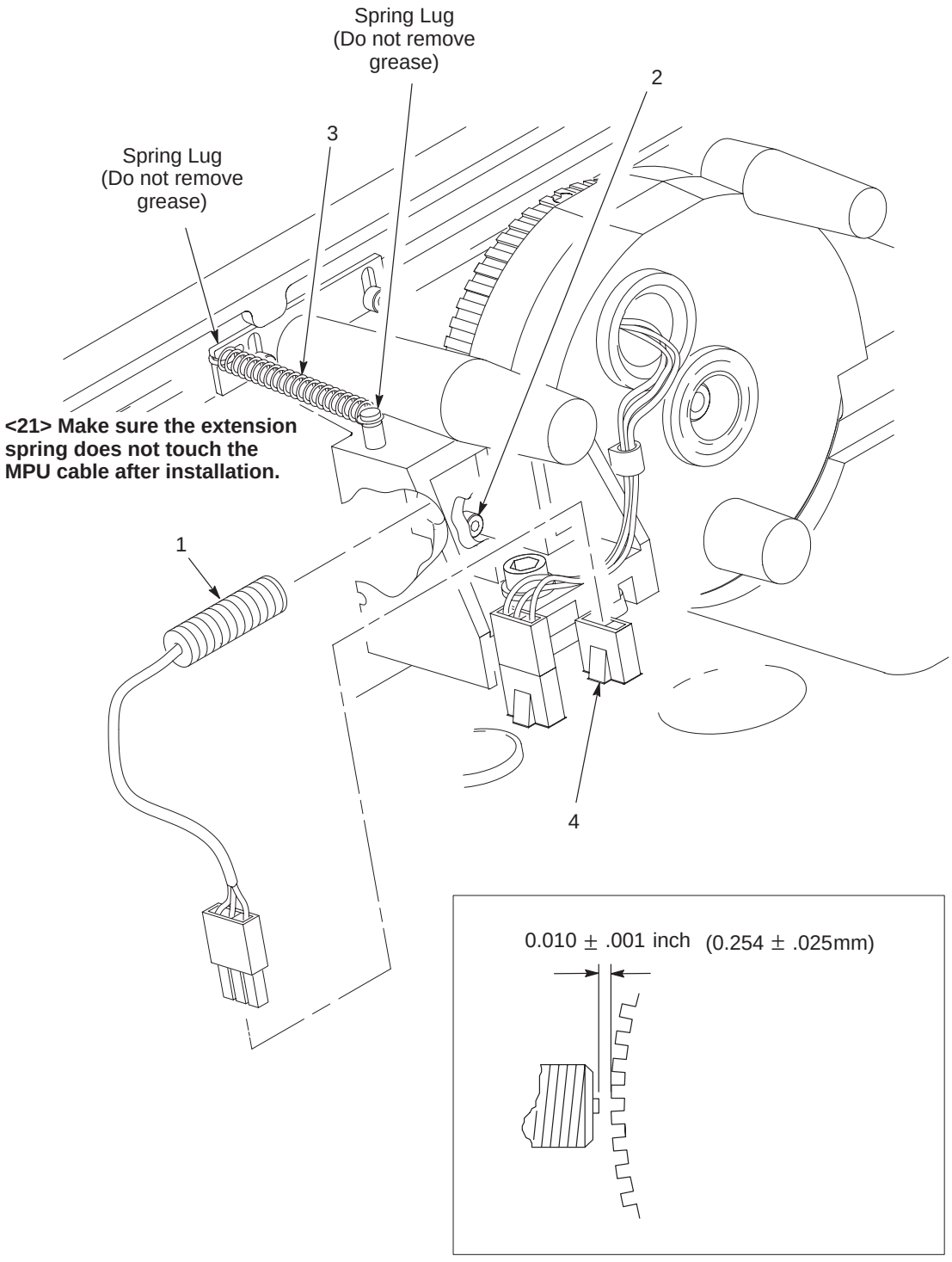

Figure 47. Magnetic Pickup Unit (MPU) and Extension Spring

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	Screw, Socket Cap, 4–40x.25	Part of item 19
2	Ref	Washer, Flat #4	Part of item 19
3	Ref	Knob, Tractor Adjust	Part of item 19
4	Ref	Bushing, Tractor Adjust	Part of item 19
5	Ref	Washer, Curved Spring (2)	Part of item 19
6	Ref	Ring, Grip	Part of item 18
7	Ref	Bearing, Nylon .626	Part of item 18
8	Ref	Link Spring	Part of item 18
9	Ref	Spring, Extension 1.00L	Part of item 18
10	Ref	Screw, Hex w/Lock Washer, 4–20x.50	Part of item 11
11	57G1521	Ground Clip, Spined Shaft	
12	57G1460	Splined Shaft Assembly	
13	Ref	Screw, Thread Forming, 6–32x.25	Part of item 18
14	Ref	Clamp, Bearing	Part of item 18
15	Ref	Tractor Support Shaft	Part of item 19
16	57G1466	Tractor Set	Includes L and R tractors
17	Ref	E-Ring	Part of item 19
18	14H5217	Tractor Shaft Hardware Kit	
19	14H5214	Tractor Shaft Kit	
20	Ref	Bushing	Part of item 18
21	24H8593	Paper Support (2)	
22	Ref	Link, Splined Shaft Skew Adjustment	

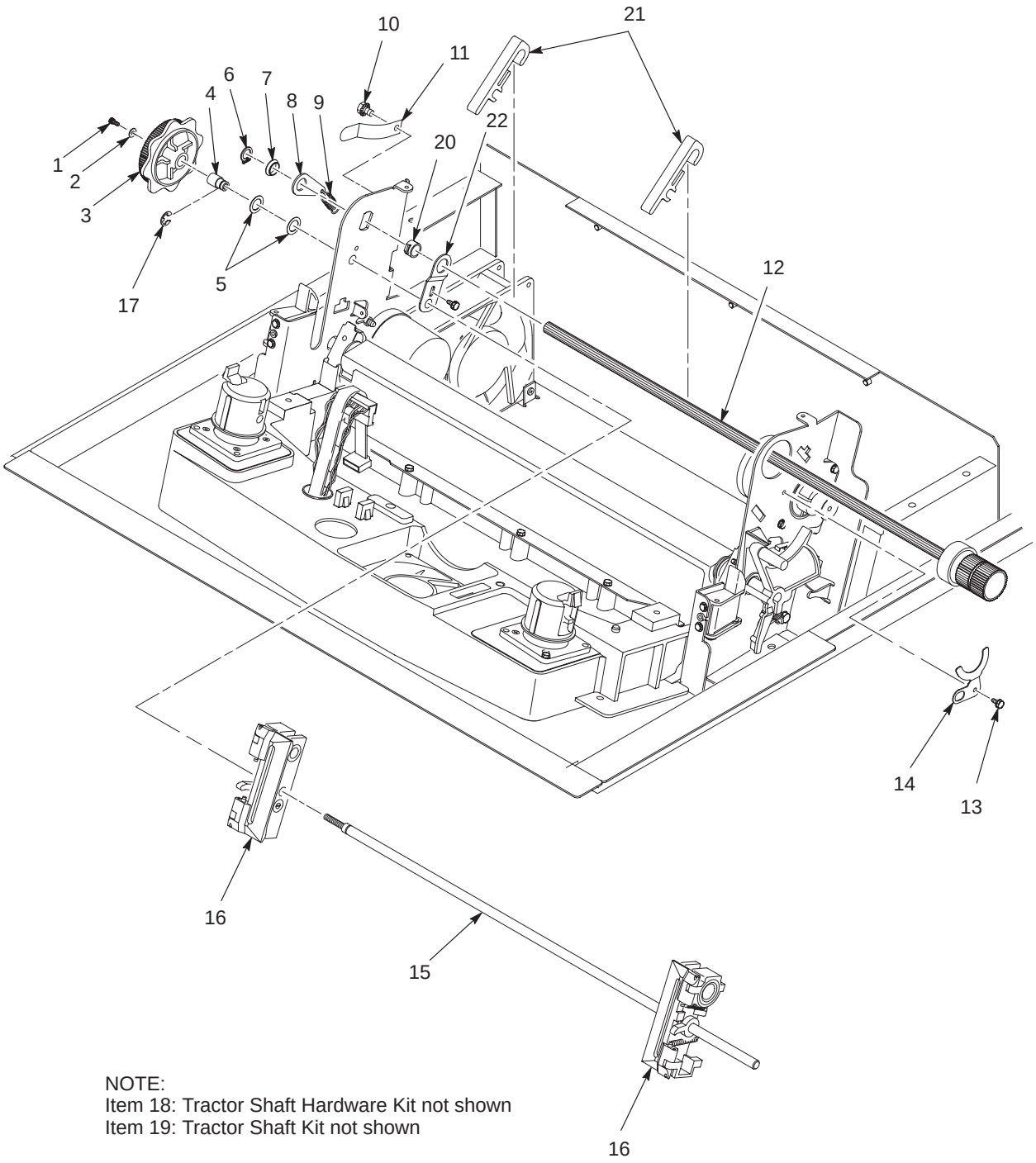

Figure 48. Tractor Shafts

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	Setscrew	Part of item 25
2	Ref	Bracket, Platen (2)	Part of item 25
3	57G1469	Ironer Assembly	Reverser Paper Feed
4	Ref	Screw, Thread Forming (3)	6–32x.25
5	57G1571	Bracket, Ironer	
6	Ref	Plate, Ironer	
7	08H7936	Platen Assembly	
8	Ref	Washer, Flat (2)	Part of item 25
9	Ref	Screw (2)	Part of item 11
10	Ref	Washer, Flat #4 (2)	Part of item 11
11	14H5280	Platen Switch Kit	
12	Ref	Screw, Socket Cap, 6–32x.75	Part of item 15
13	Ref	Washer	Part of item 15
14	Ref	Nut	Part of item 15
15	63H7478	Platen Lever Kit	
16	Ref	Spring, Extension 1.12L	Part of item 25
17	Ref	Link, Spring	Part of item 25
18	Ref	Bearing, Nylon .376	Part of item 25
19	Ref	Bracket, Switch Mount	Part of item 11
20	Ref	Wear Saddle, Platen (2)	Part of item 25
21	57G1514	Platen Pulley, Driven	
22	Ref	Screw, Socket Cap, 6–32x.44	Part of item 21
23	57G1467	Belt, Timing, 312W, 87 Teeth	Platen Open Belt
24	14H5174	Platen/Paper Feed Cover Kit	Platen open belt cover shown in Figure 49. Paper feed belt cover: page 269, item 7.
25	14H5169	Platen Hardware Kit	
26	Ref	Platen Washer	Part of item 25

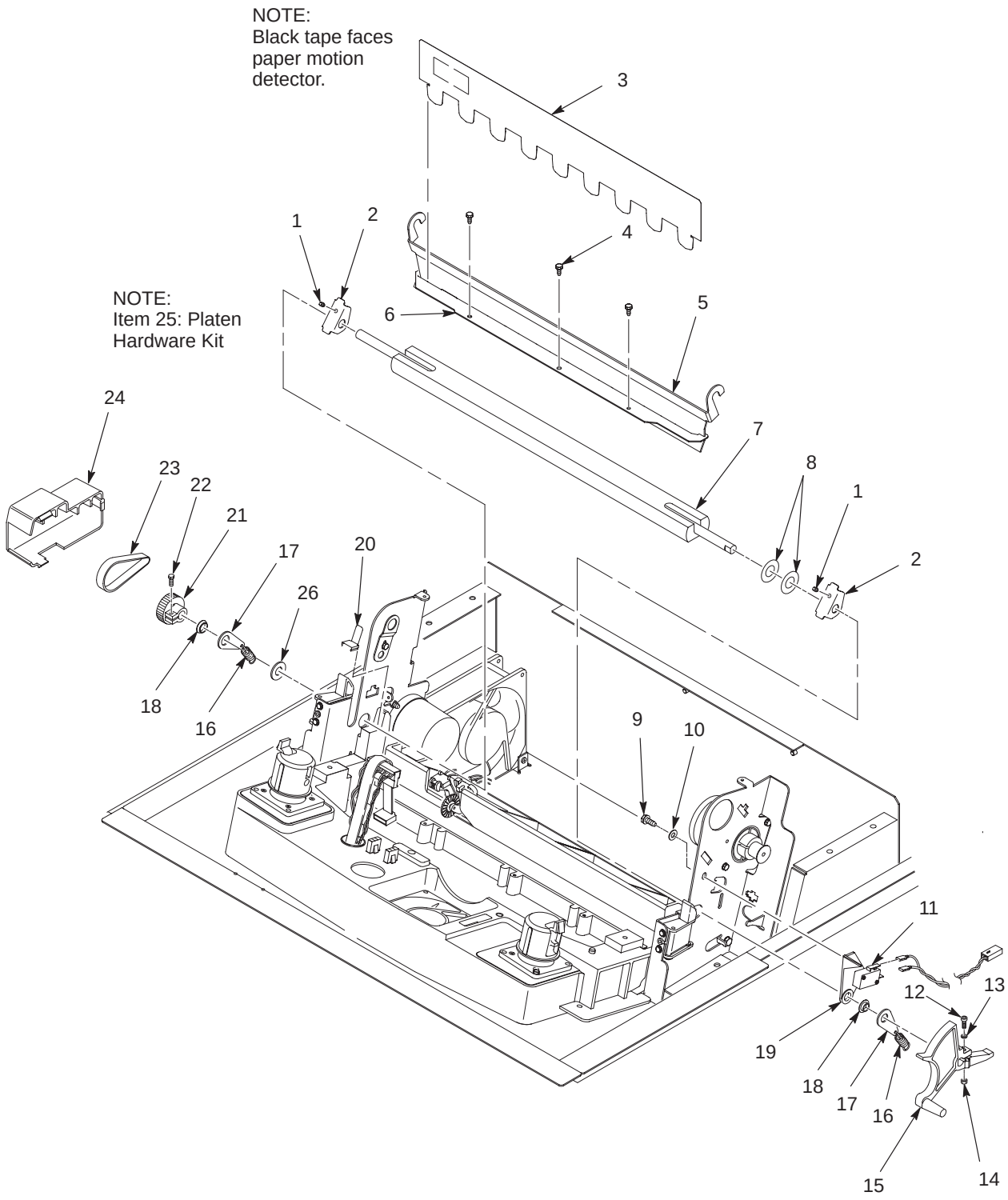

Figure 49. Platen

Item No.	Part No. (Order No.)	Description	Notes
1	57G1440	Fan Assembly	Air flow is into card cage
2	Ref	Screw, w/Lock Washer (3)	Two 6–32x1.75 on botton One 6–32x0.50 on top left
3	14H5281 63H5133	Paper Detector Switch Assy Paper Detector Switch Assy	Standard Black Back forms
4	Ref	Screw, Thread Forming, 6–32x.375	
5	14H5520	Paper Feed Motor Assy	Includes items 7 through 9
6	08H7934	Motor Pulley, Platen Open	Part of Platen Open Motor Assy 57G1509 and includes collar setscrew 6–32x.25
7	Ref	Collar	Part of item 9
8	Ref	Screw, Socket Head, 6–32x.51	
9	57G1421	Motor Pulley, Paper Feed	
10	Ref	Screw, Hex w/Lock Washer (2)	10–32x.50
11	24H8894	Ribbon Guide Kit	Includes left and right ribbon guides
12	14H5154	Platen Open Motor Assembly	Includes item 6
13	Ref	Washer, Flat #4 (2)	
14	Ref	Screw, Hex w/Lock Washer (2)	4–40x.38
15	Ref	Screw, Hex w/Lock Washer (2)	10–32x.50
16	Ref	Shield, Card Cage Fan	
17	14H5521	Motor Assembly, Ribbon	
18	Ref	Screw, Hex w/Lock Washer (2)	6–32x.50
19	Ref	Washer, Flat #6 (2)	
20	57G1479	Ribbon Hub Kit	
21	Ref	Screw, w/Lock Washer (2)	6–32x1.25
22	14H5159	Hammer Bank Fan Assembly	Air flow is up
23	Ref	Boot	Cabinet models only

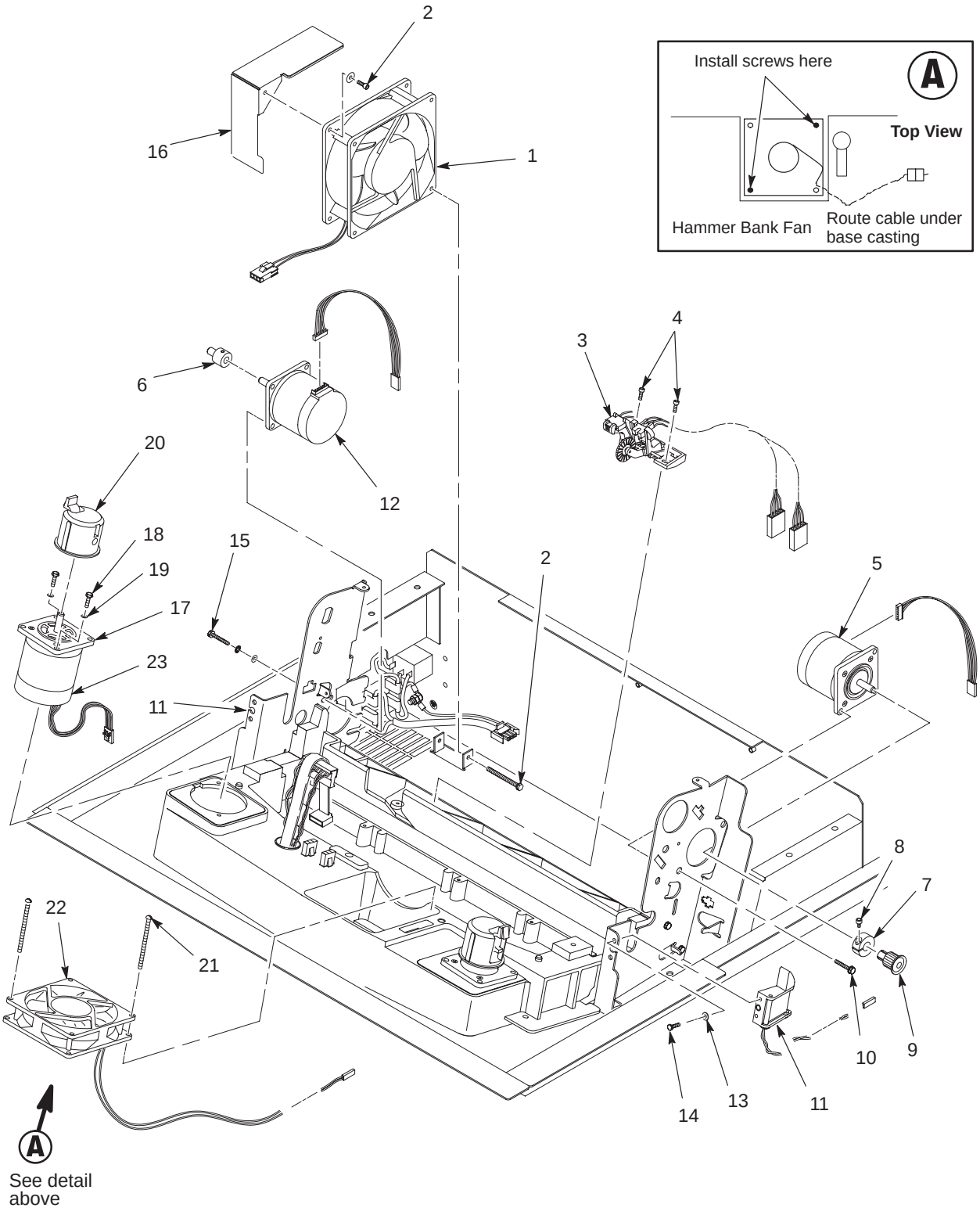

Figure 50. Motors, Card Cage Fan, and Paper Detector Switch

Item No.	Part No. (Order No.)	Description	Notes
1	14H5571	Circuit Breaker	
2	Ref	IEC 320 AC Power Connector	Connector J301
3	Ref	Chassis Ground Stud	
4	Ref	Connector P1	To power supply board connector J1 AC
5	Ref	Cable Assy, AC In, Power Supply	Part of Field Kit, AC Assy 14H5289

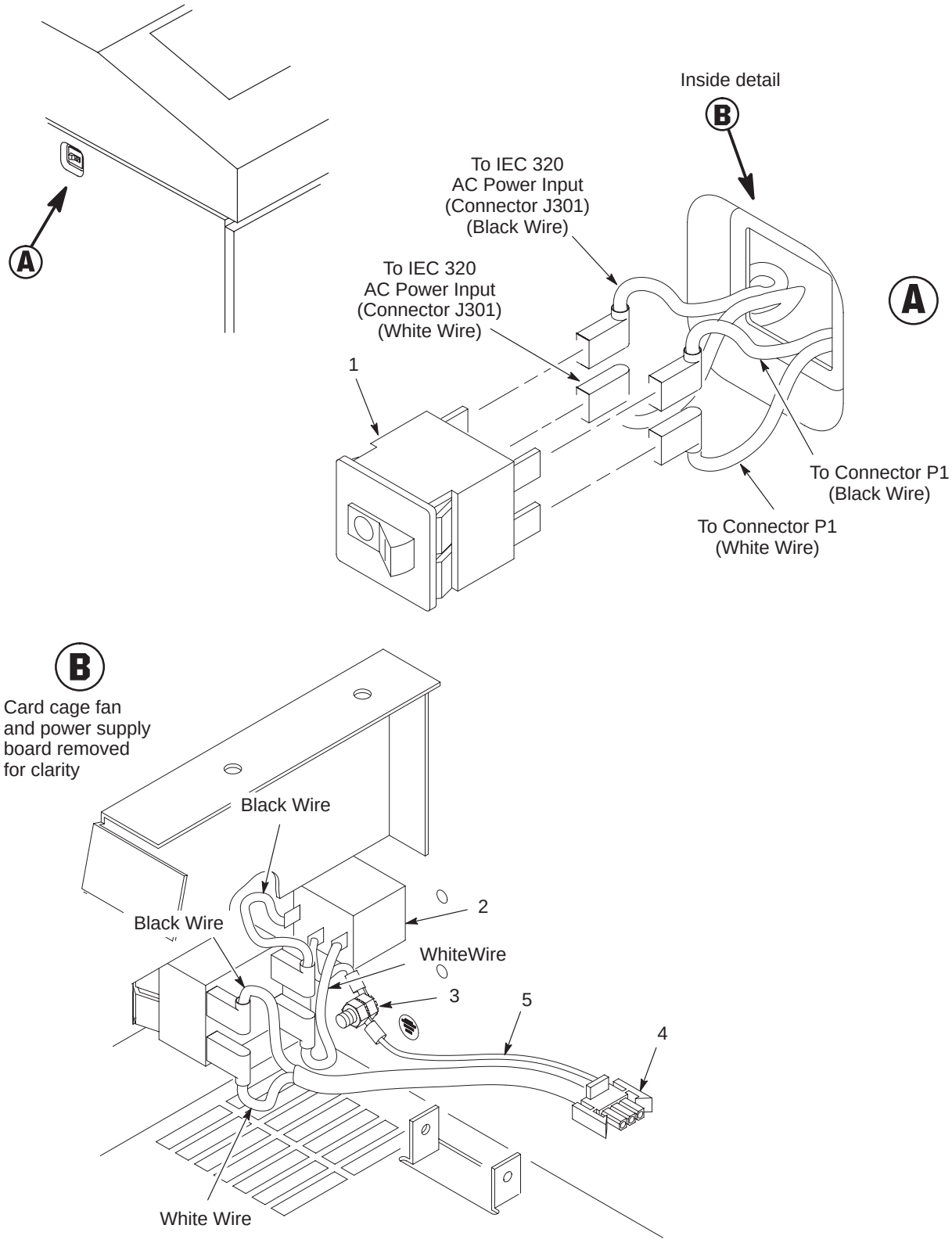

Figure 51. Circuit Breaker

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	Screw (2)	
2	Ref	Card Cage	
3	24H9011	IBM Coax/Twinax Expansion	
4	Ref	Screw, Captive	
5	Ref	Standoff, Hex, 3/16 inch	M/F, .813 Lg.
6	24H8535	Adapter, Expansion Connector	60-pin
7	Ref	CMX Controller Board	
8	Ref	Controller Board Connector J111	

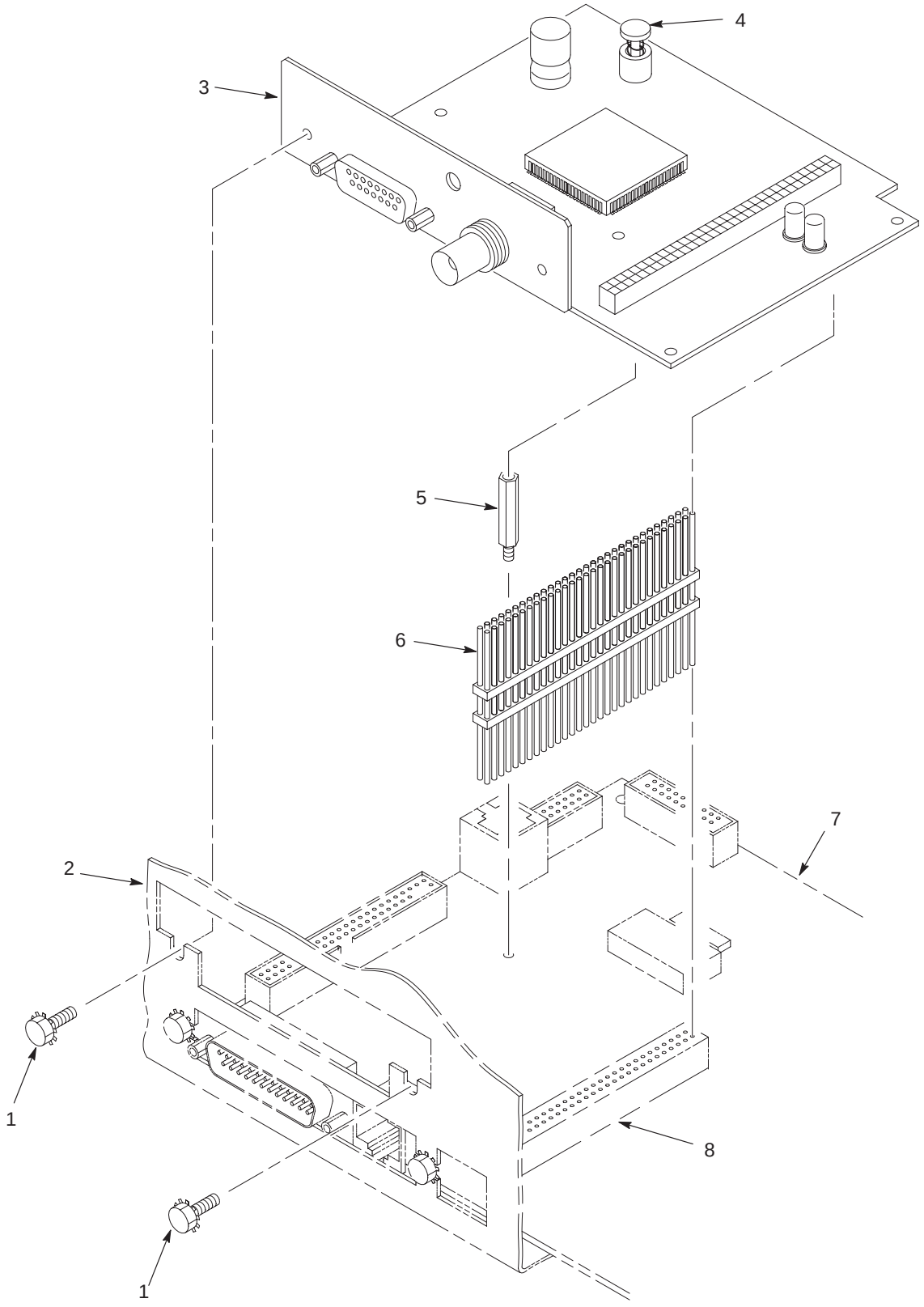

Figure 52. IBM Coax/Twinax Expansion Board

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	Screw, Connector Cover (2)	
2	Ref	Cover Plate, Centronics	
3	Ref	Ferrite Clamp	See also Appendix I
4	Ref	CMX Controller Board	
5	14H5287	Centronics I/O Cable Assembly	
6	24H8995	Ethernet LAN PCBA, 10-Base-T	
7	24H8994	Ethernet LAN PCBA, 10-Base-2	
8	Ref	Rear of Card Cage	
9	Ref	Screw (2)	

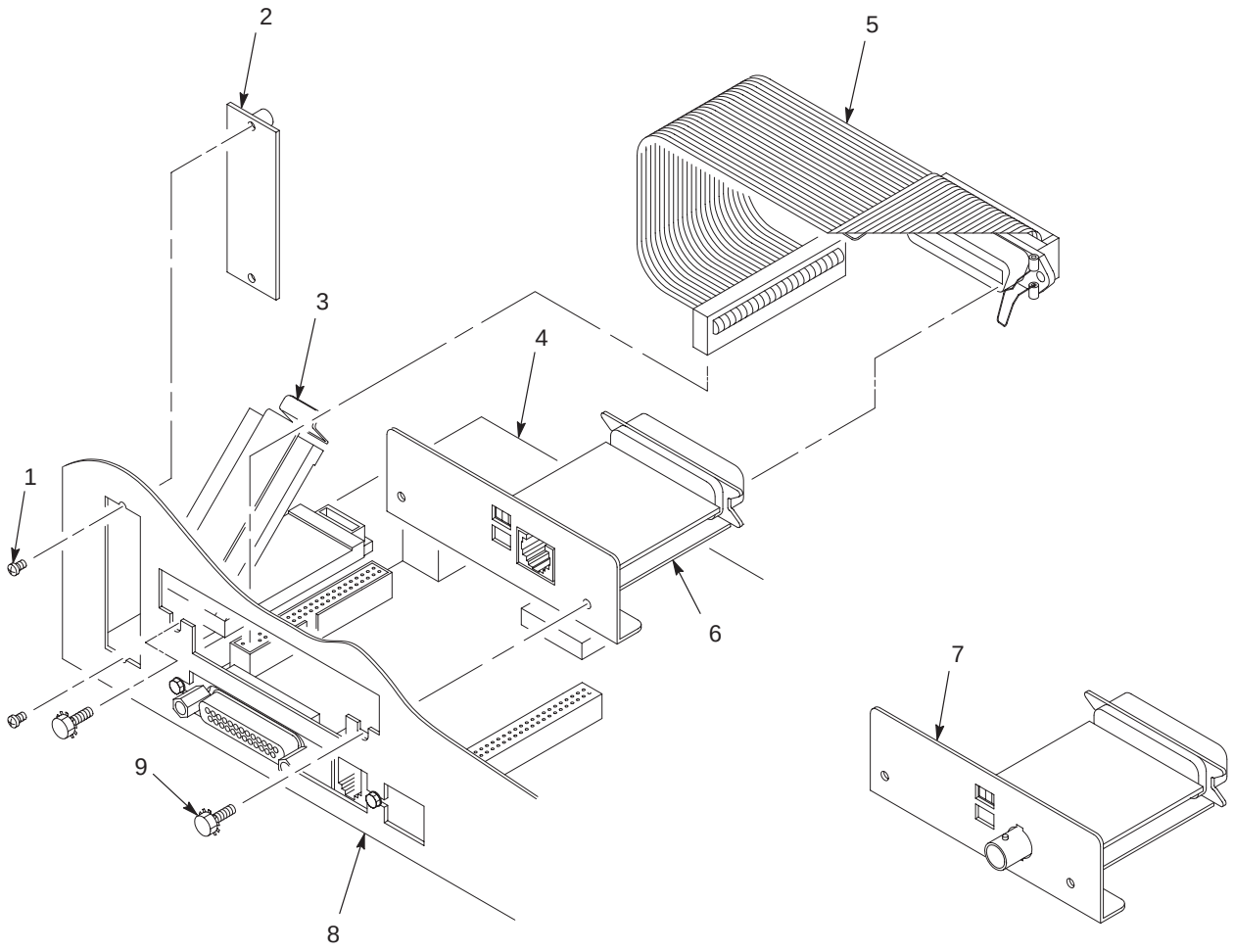

Figure 53. Ethernet Interface Assemblies

A Wire Data

NOTE: Acronyms and Signal mnemonics are defined in Appendix F.

IBM 6400 Interconnection Diagram 295

IBM 6400 Power Distribution Diagram 296

IBM 6400 Main Wire Harness Test Tables 297

Circuit Board Pinouts

- Controller, CMX 298
- Power Supply 302
- Expansion Coax/Twinax 303
- SureStak** Power Stacker Control Panel PCBA 304

Cable Routing

- Cabinet Model 305
- Cabinet Model, Mechanism Base 306
- Pedestal Model 307
- Pedestal Model, Mechanism Base 308

Cable Assemblies

- AC In, Power Supply 309
- AC Power Input 310
- Card Cage Fan 311
- Operator Panel 312
- Exhaust Fan 313
- Hammer Bank Logic 314
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Ribbon Guide Kit 318
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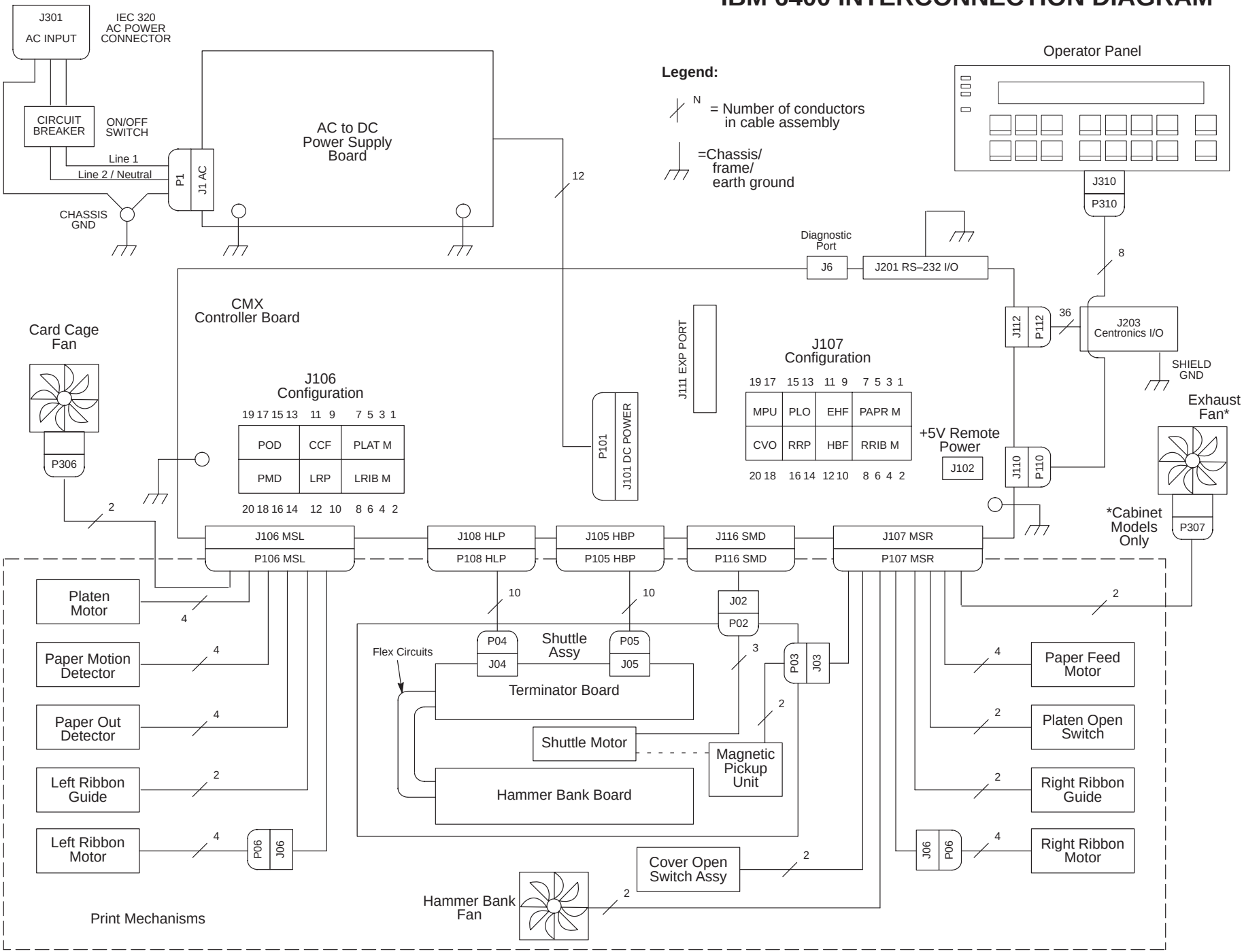
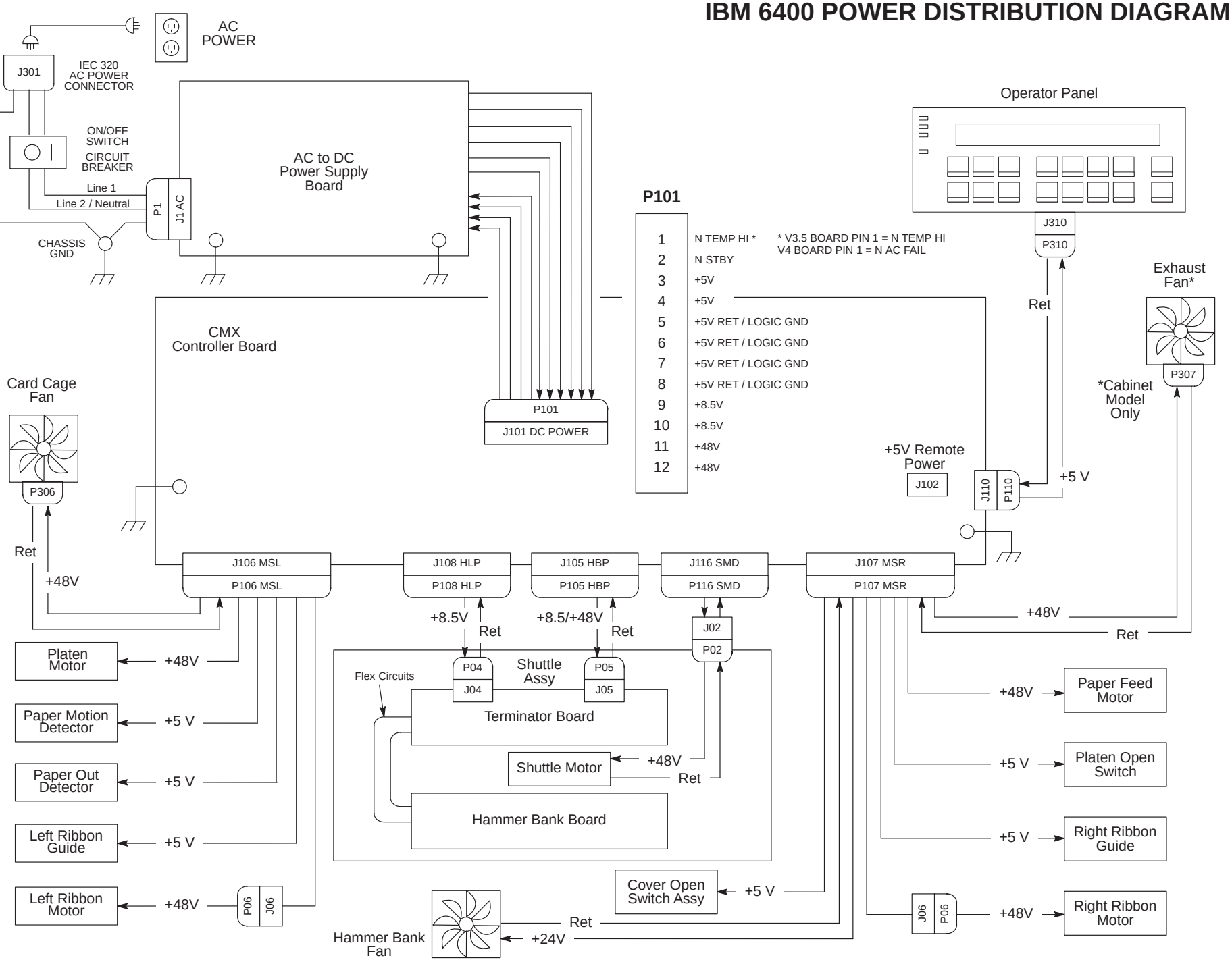
IBM 6400 INTERCONNECTION DIAGRAM



IBM 6400 POWER DISTRIBUTION DIAGRAM



IBM 6400
Main Wire Harness Test Tables

PIN NO.

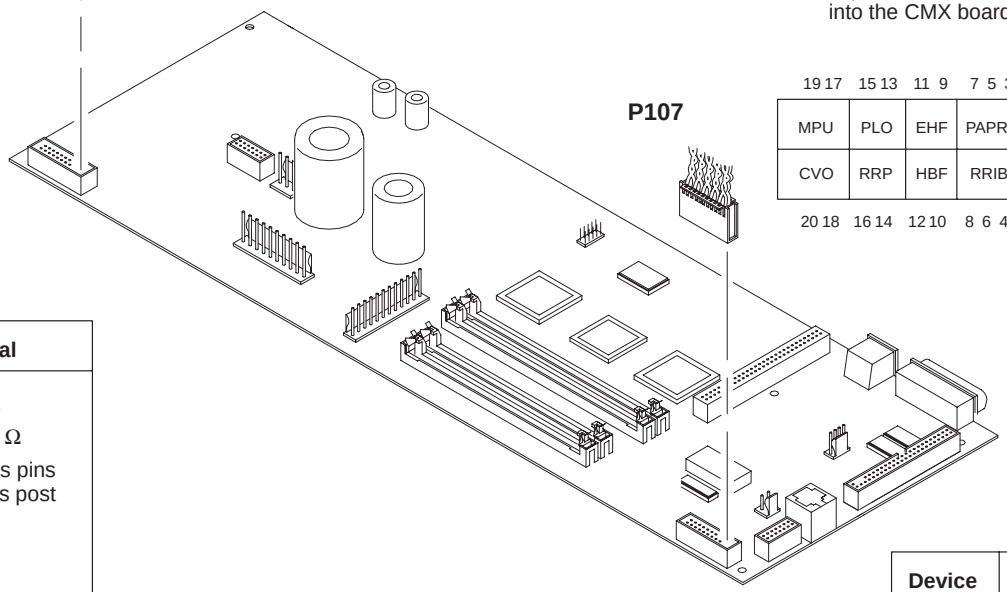
Top view; as seen when plugged into the CMX board.

19 17	15 13	11 9	7 5 3 1
POD	CCF		PLAT M
PMD	LRP		LRIB M
20 18	16 14	12 10	8 6 4 2

P106

CCF = Card Cage Fan
LRIB M = Left Ribbon Motor
LRP = Left Ribbon Post
PLAT M = Platen Open Motor
PMD = Paper Motion Detect (Switch)
POD = Paper Out Detect (Switch

NOTE: For cable shell connector assembly/disassembly, see Figure 30 on page 199.



P107

Top view; as seen when plugged into the CMX board.

PIN NO.

19 17	15 13	11 9	7 5 3 1
MPU	PLO	EHF	PAPR M
CVO	RRP	HBF	RRIB M
20 18	16 14	12 10	8 6 4 2

CVO = Cover Open (Switch)
EHF* = Exhaust Fan
HBF = Hammer Bank Fan
MPU = Magnetic Pickup
PAPR M = Paper Feed Motor
PLO = Platen Open (Switch)
RRIB M = Right Ribbon Motor
RRP = Right Ribbon Post

*Only in cabinet models

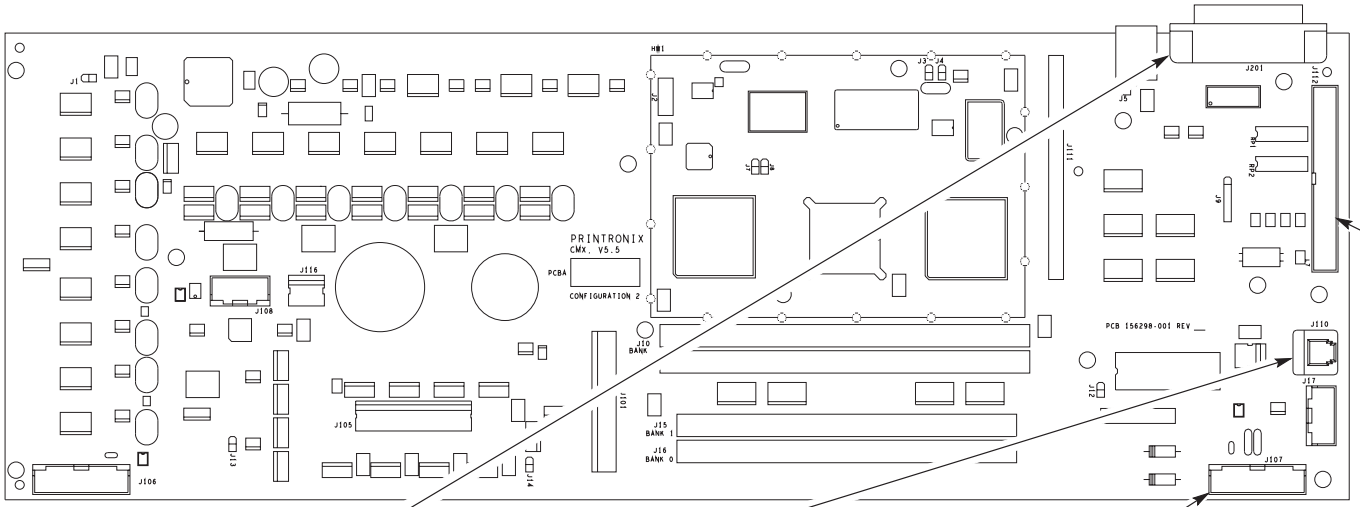
Resistance

Device	P106 Pins	Normal
LRIB M	2, 4 and 6, 8	7.2 – 8.8 Ω
PLAT M	1, 3 and 5, 7	1.35 – 1.65 Ω
LRP	10, 12	Open across pins Short across post
CCF	9, 11	4.6 KΩ
PMD	14, 16	8 MegΩ
	18, 20	Open
POD	13, 15	8 MegΩ
	17, 19	Open

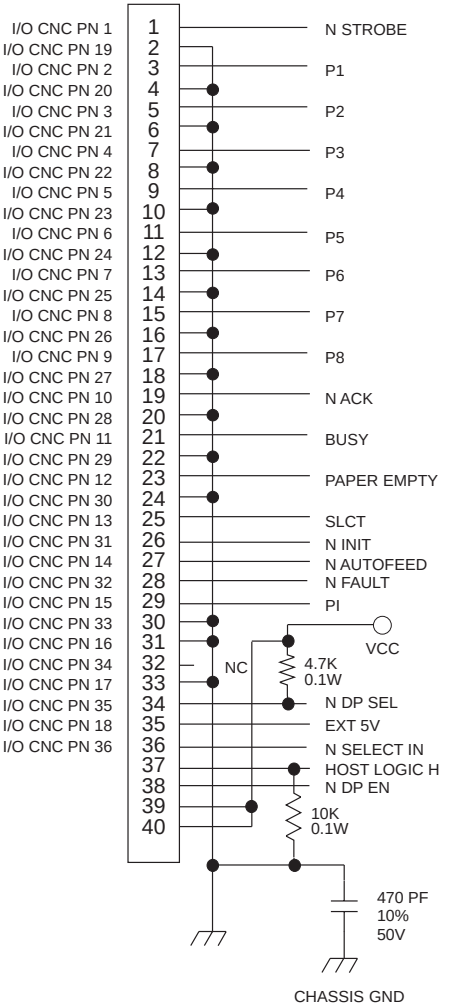
Resistance

Device	P107 Pins	Normal
RRIB M	2, 4 and 6, 8	7.2 – 8.8 Ω
PAPR M	1, 3 and 5, 7	0.417 – 0.681 Ω
HBF	10, 12	2.7 KΩ
EHF	9, 11	4.6 KΩ
RRP	14, 16	Open across pins Short across post
PLO	13, 15	Continuity: switch closed Open: switch open
CVO	18, 20	Continuity: switch closed Open: switch open
MPU	17, 19	670 Ω

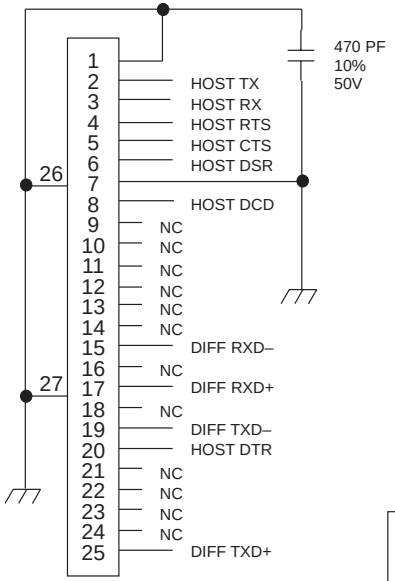
Controller, CMX



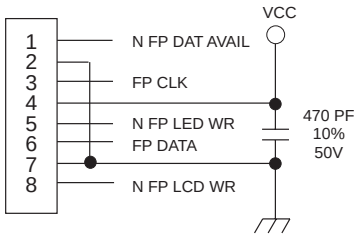
J112
Centronics



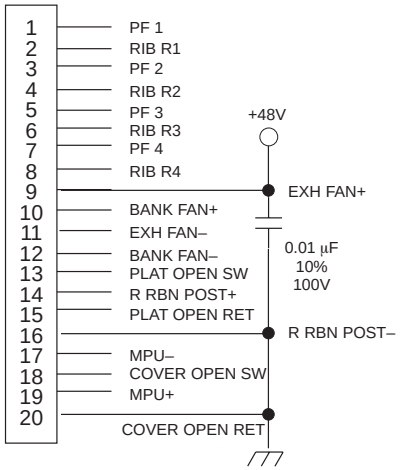
J201
RS232/RS422



J110
Front Panel



J107
Motor Sensor Right

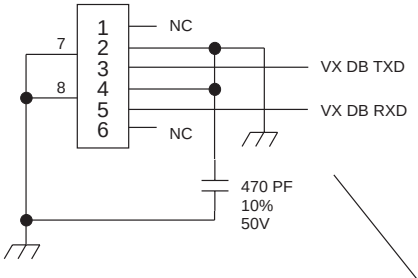


CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

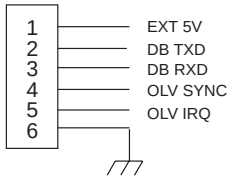
Controller, CMX

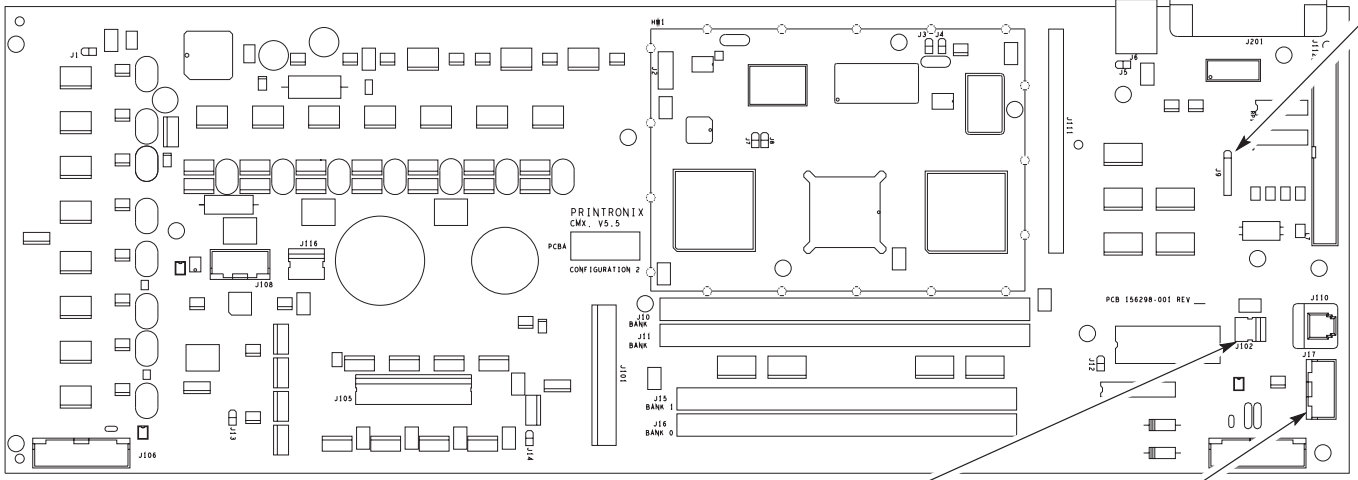
CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

J6
Diagnostic Port

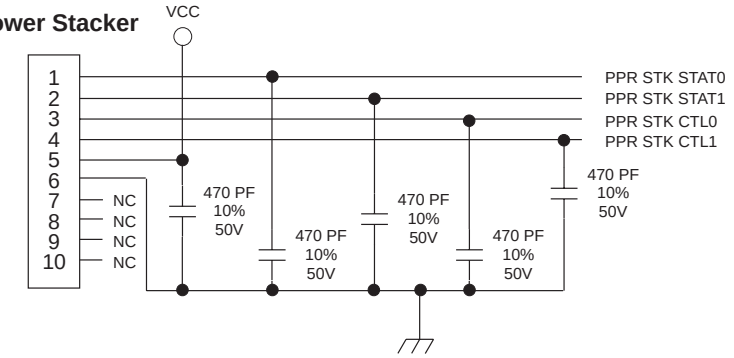


J9
Online Verifier

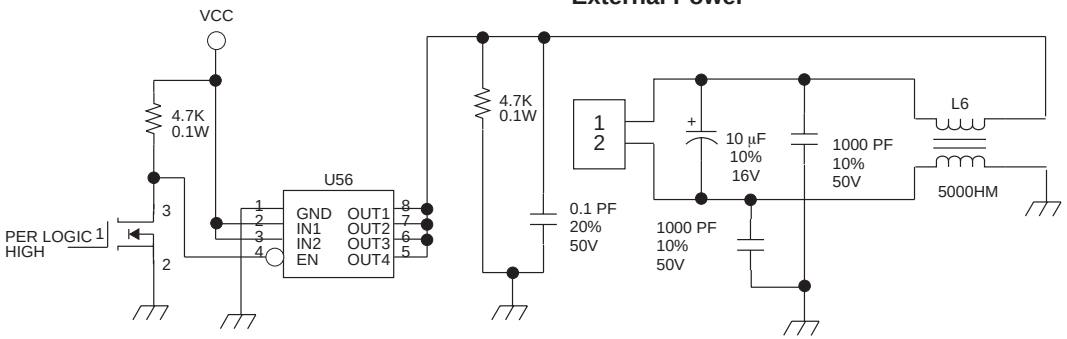




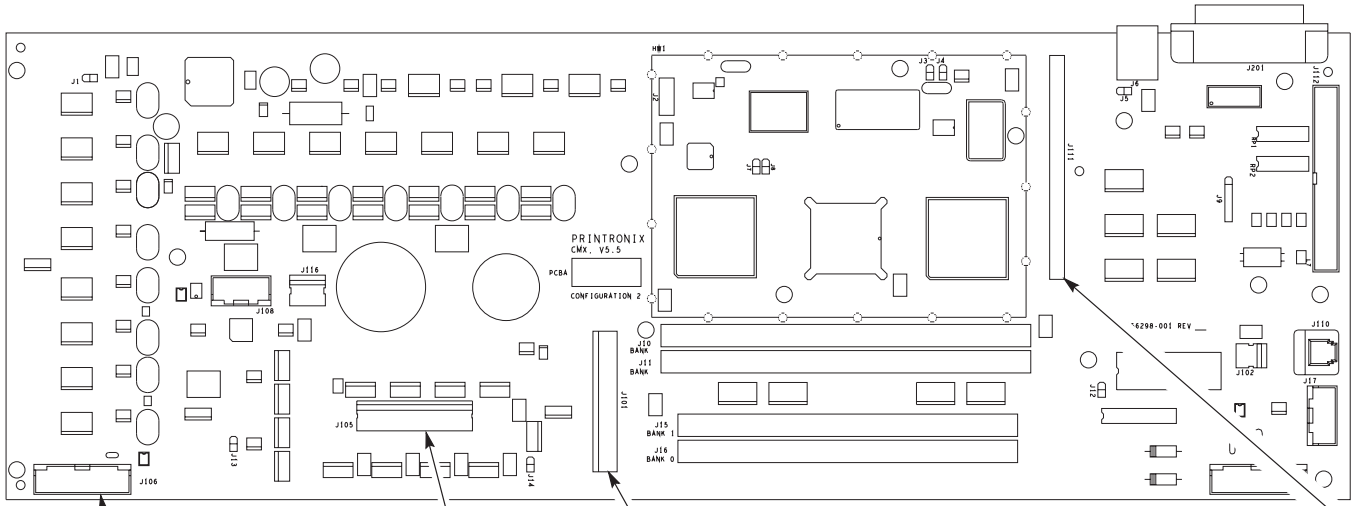
P103/J17
Power Stacker



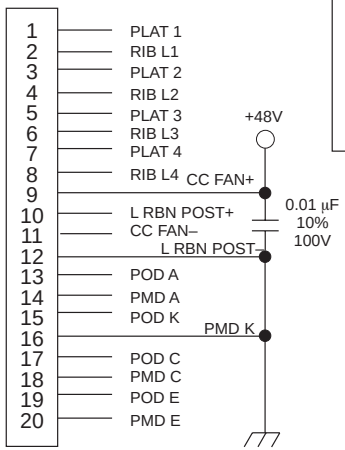
J102
External Power



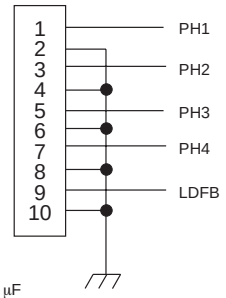
Controller, CMX



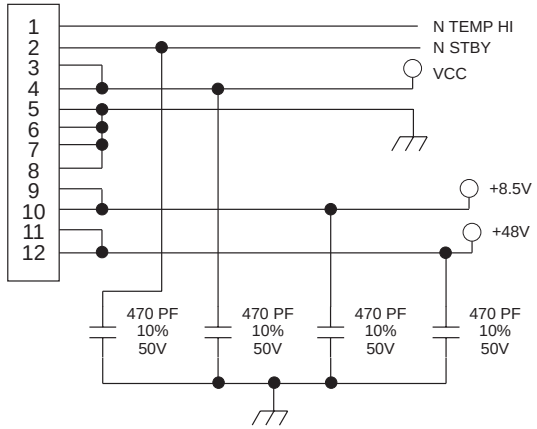
J106
Motor Sensor Left



J105
Hammer Bank Power

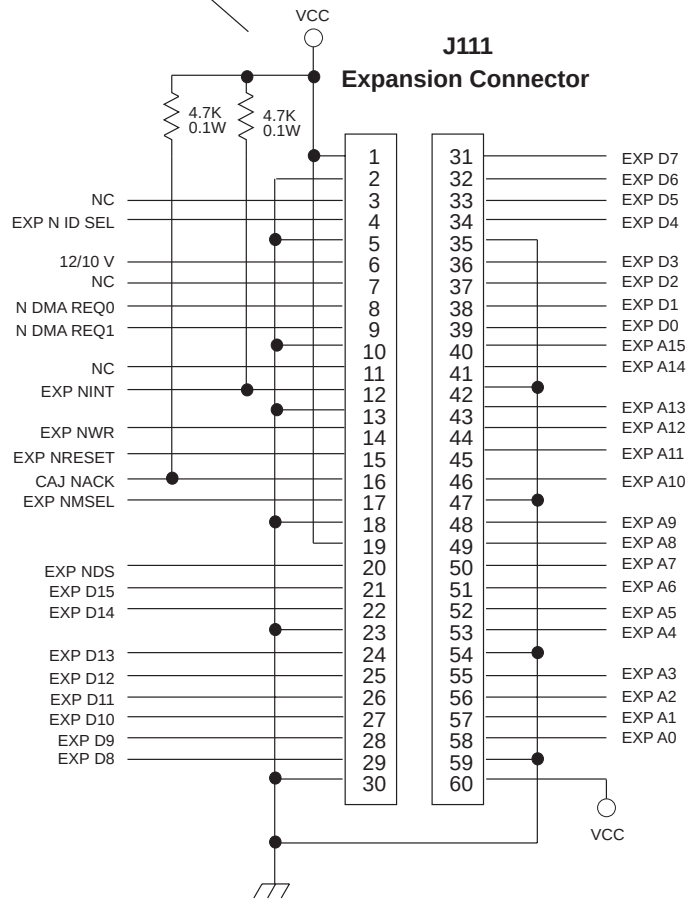


J101
Power Supply + Stacker Power

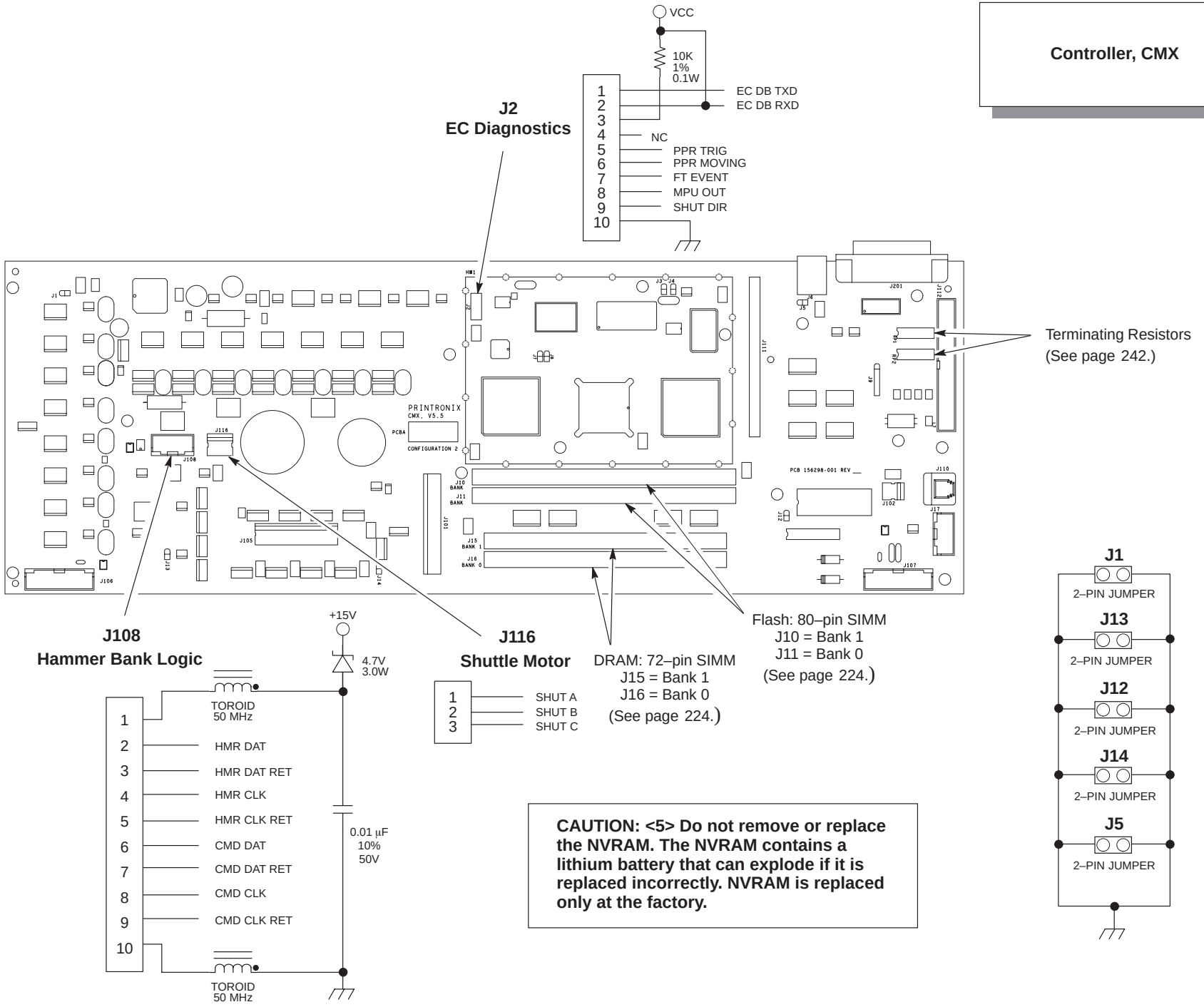


CAUSTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

J111
Expansion Connector

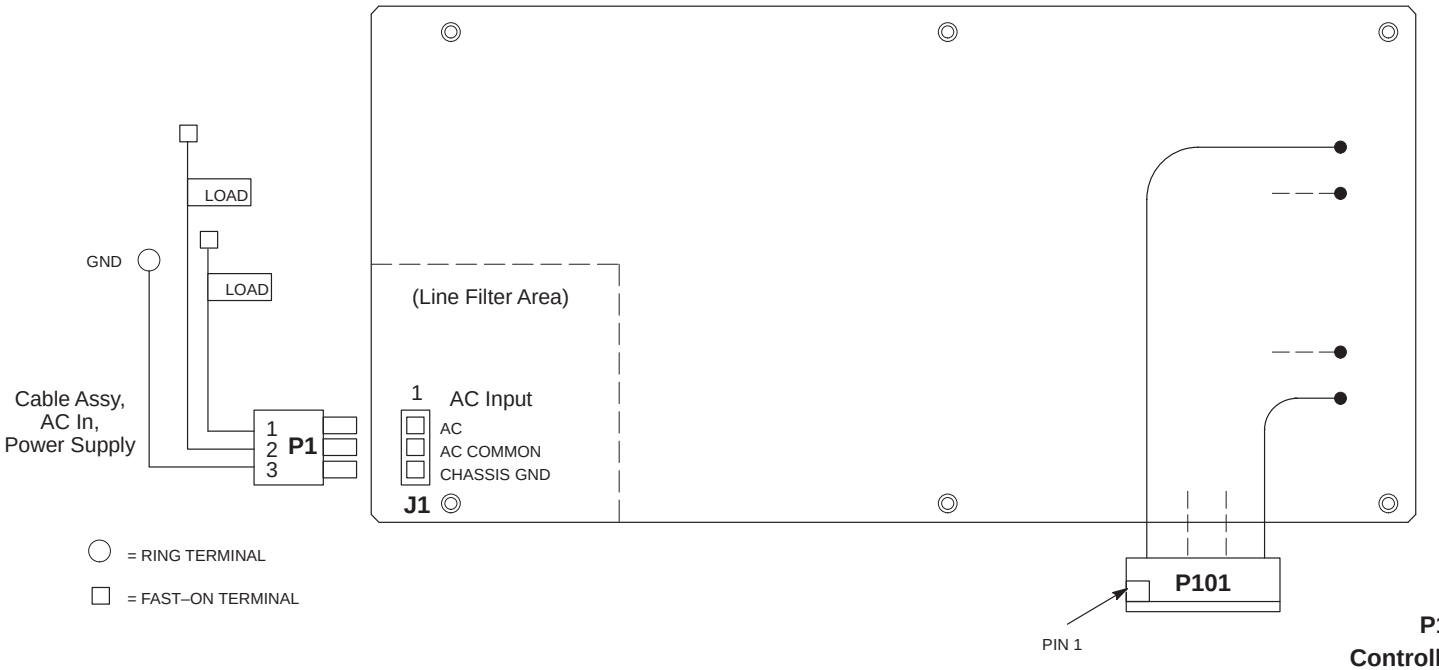


Controller, CMX

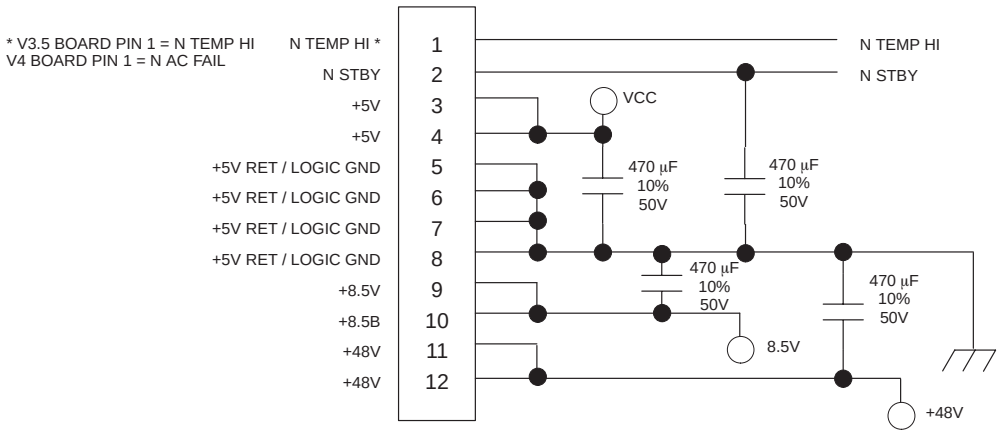


CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

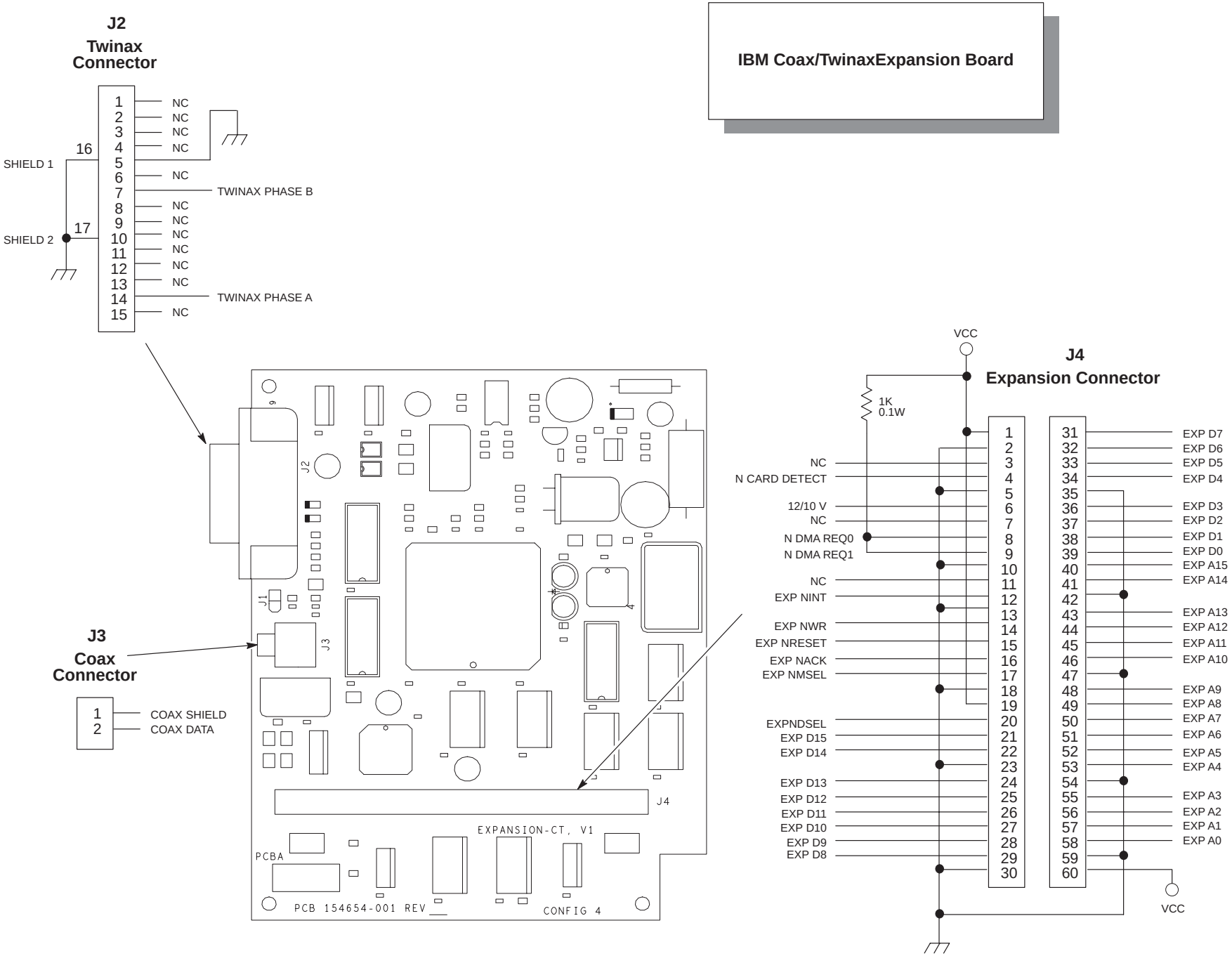
Power Supply



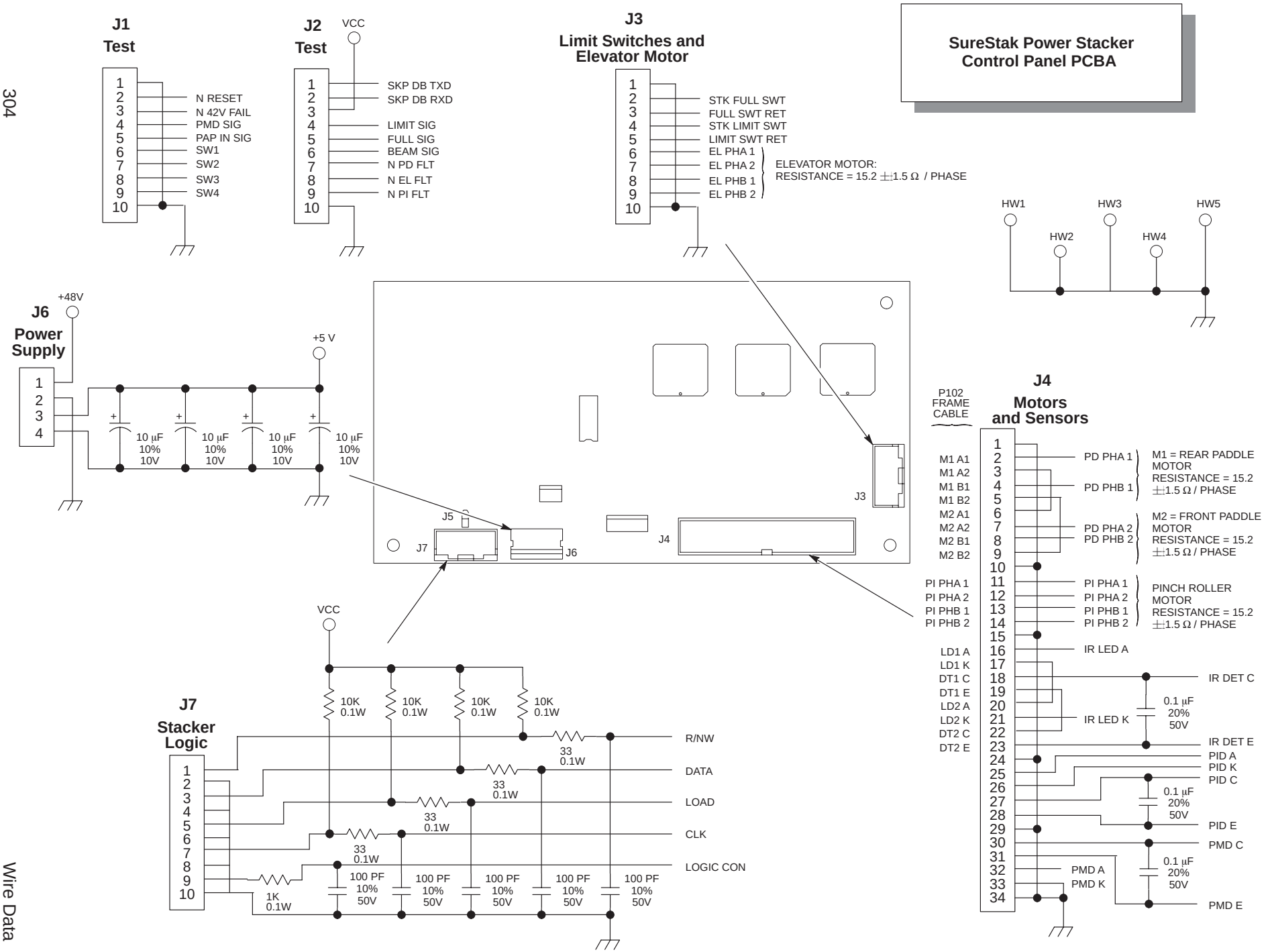
P101
Controller Board



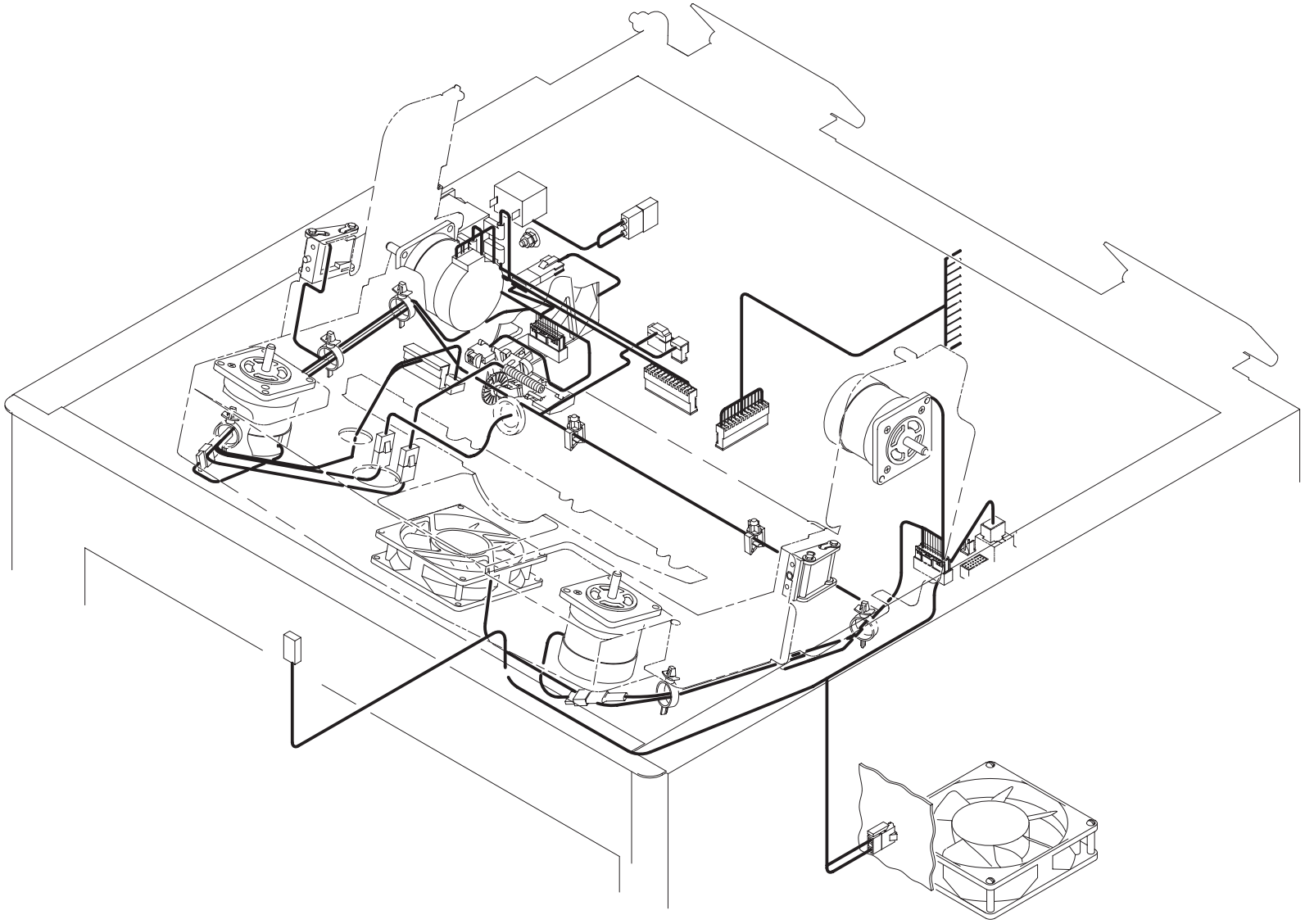
IBM Coax/TwinaxExpansion Board

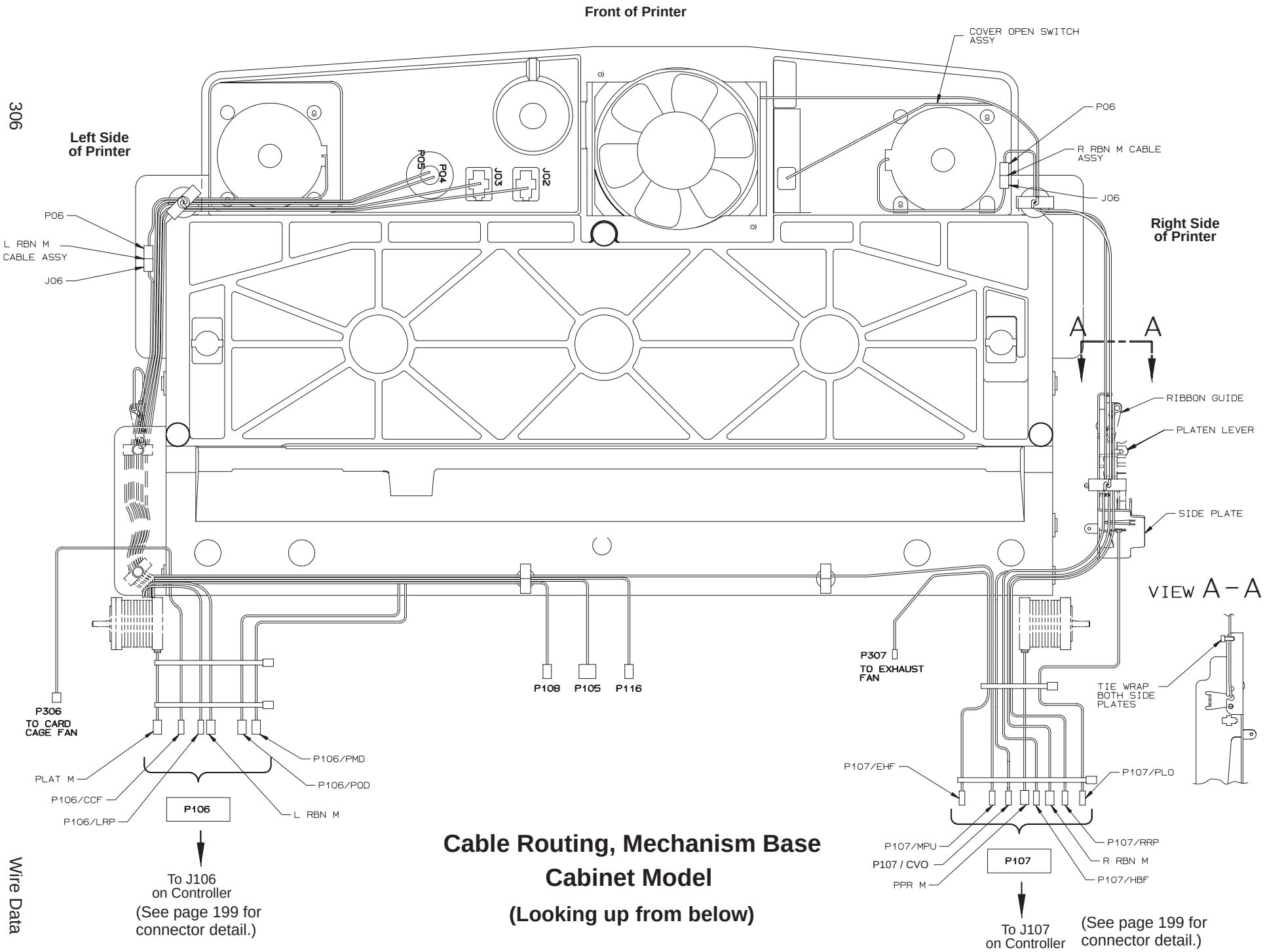


SureStak Power Stacker Control Panel PCBA



Cable Routing, Cabinet Model

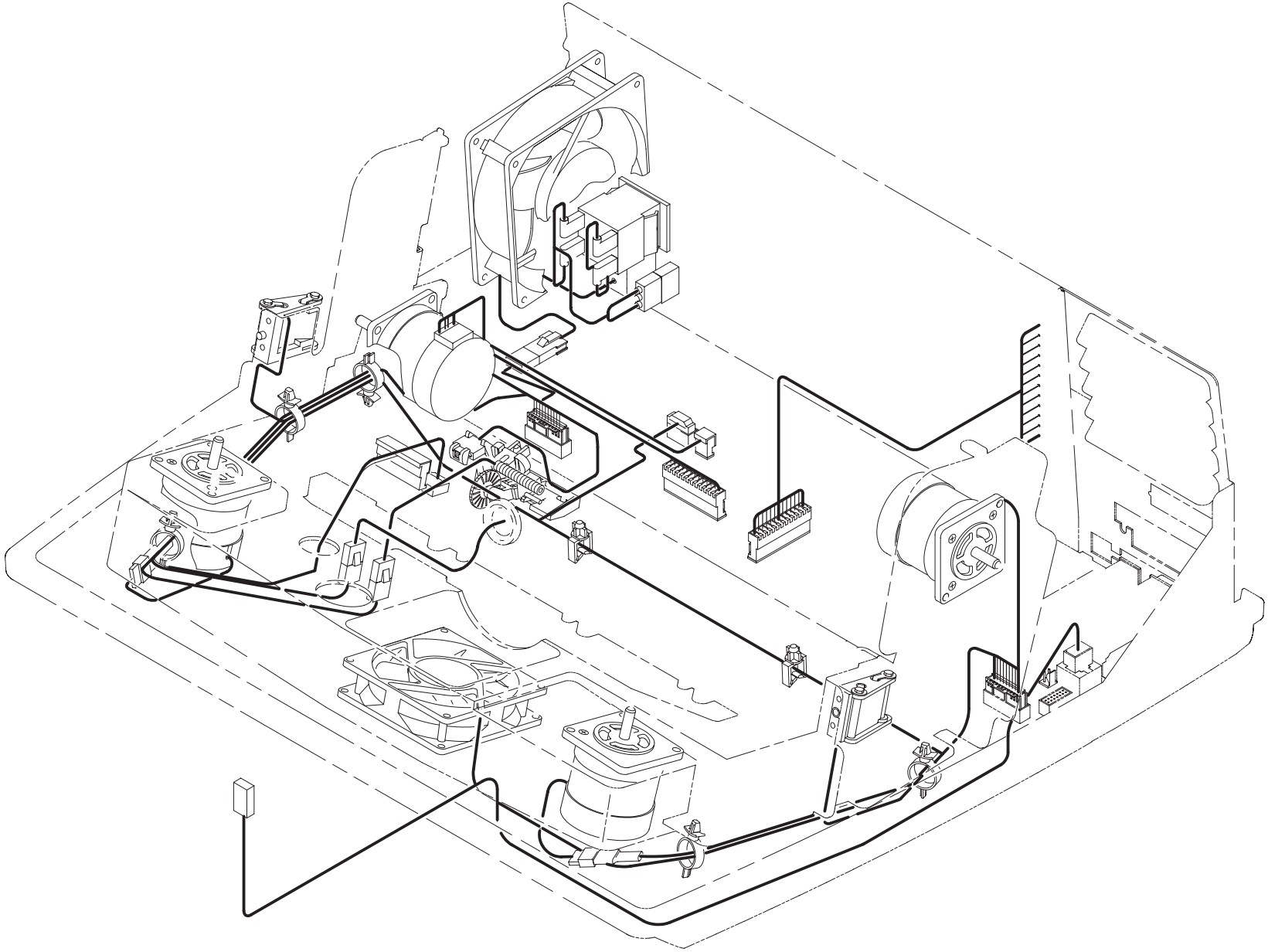


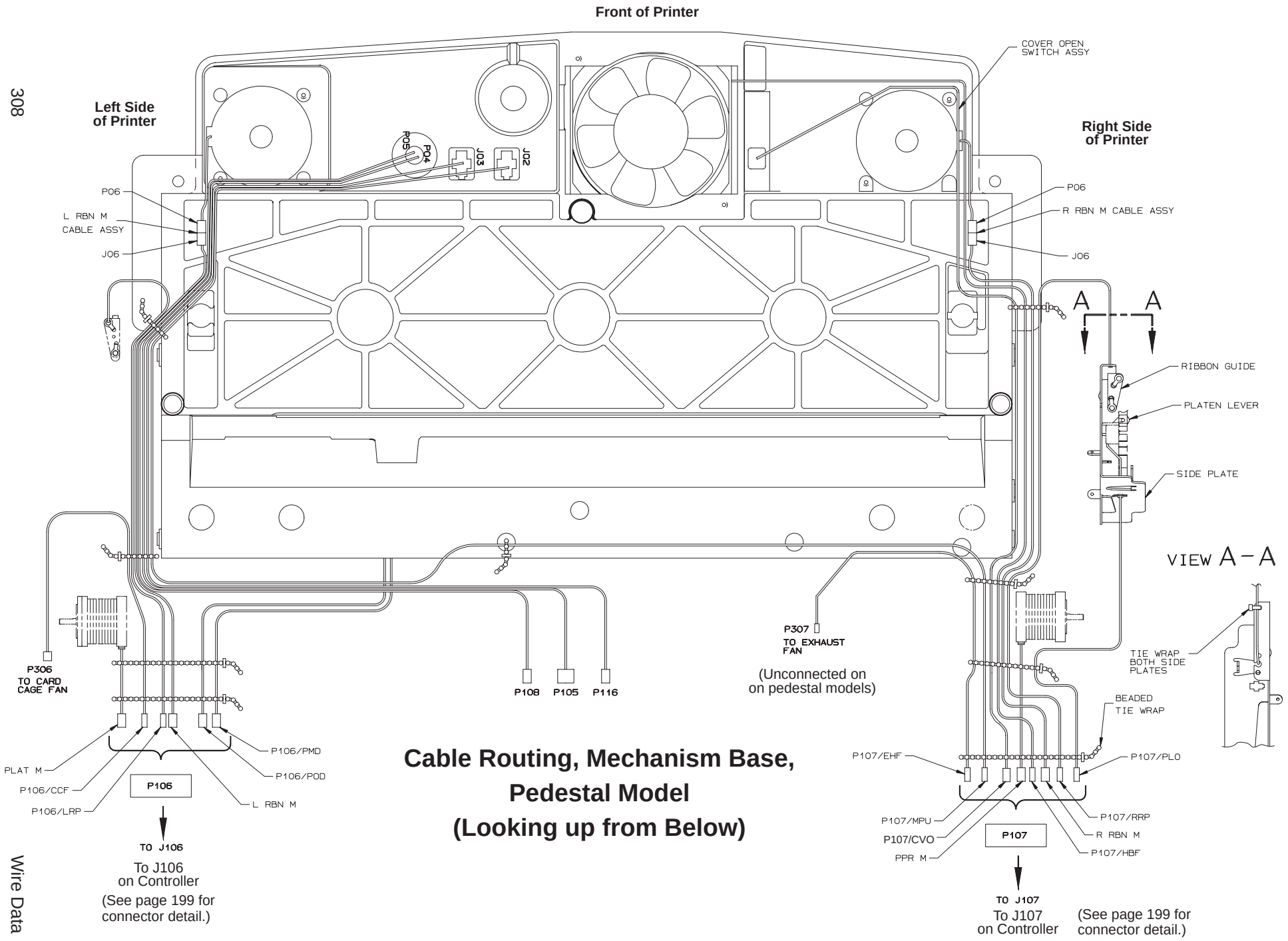


Cable Routing, Mechanism Base Cabinet Model

(Looking up from below)

Cable Routing, Pedestal Model





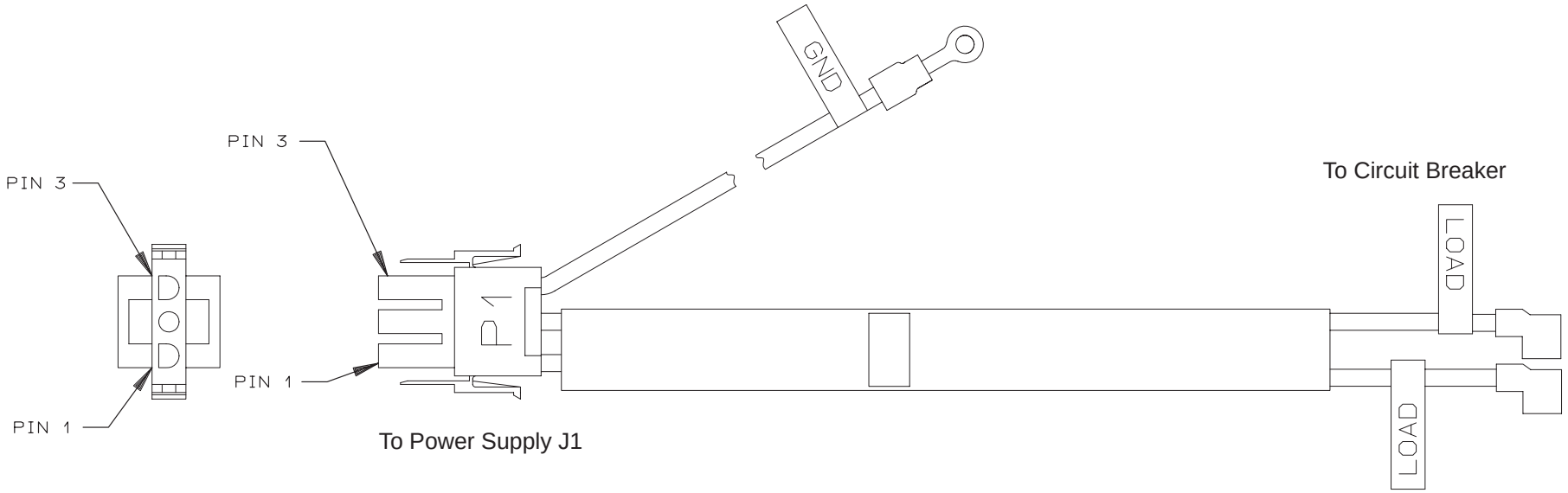
Cable Routing, Mechanism Base, Pedestal Model (Looking up from Below)

To J106 on Controller

(See page 199 for connector detail.)

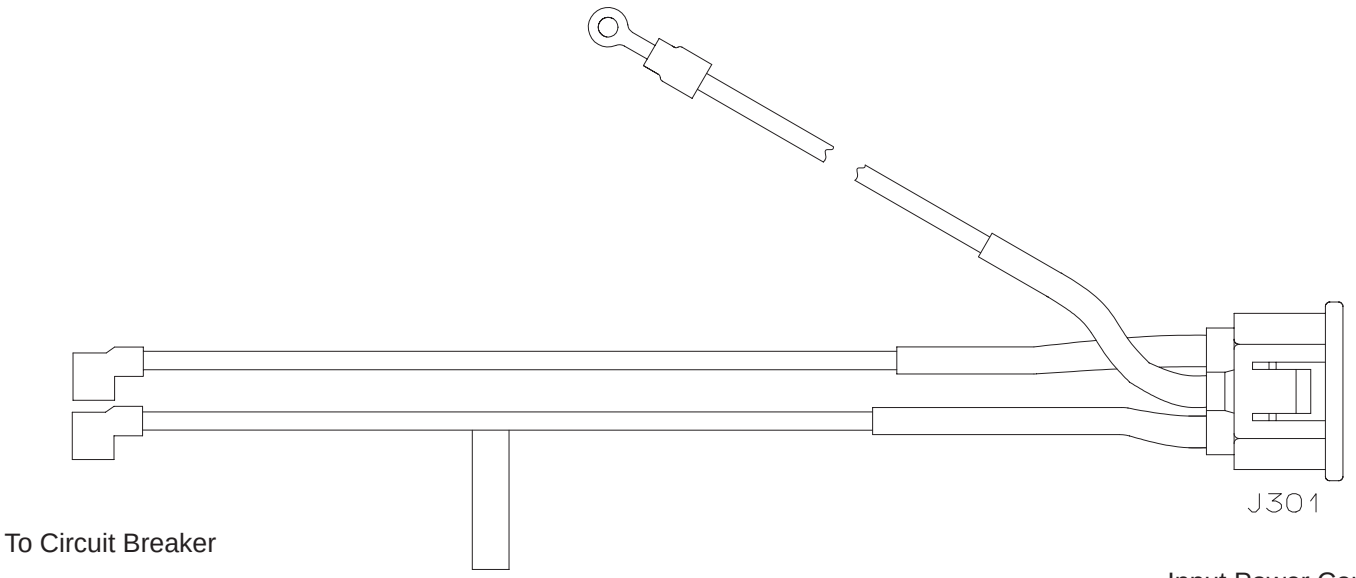
To J107 on Controller

(See page 199 for connector detail.)



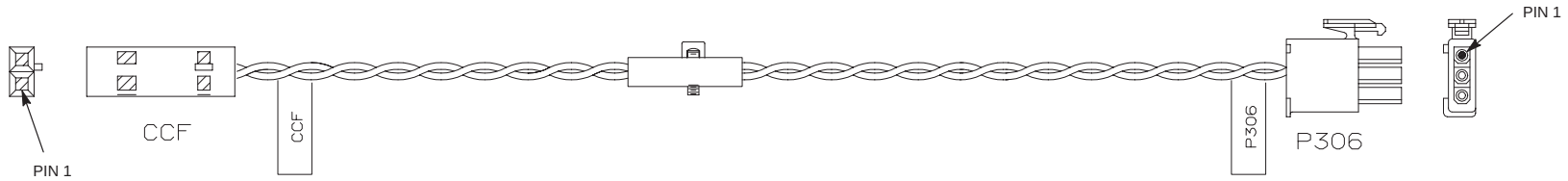
PIN	WIRE COLOR
1	BLACK
2	WHITE
3	GREEN/YELLOW

Part No.	Description
14H5289	Cable Assembly, AC In, Power Supply



PIN	WIRE COLOR
LINE	BLACK
NEUTRAL	WHITE
GROUND	GREEN/YELLOW

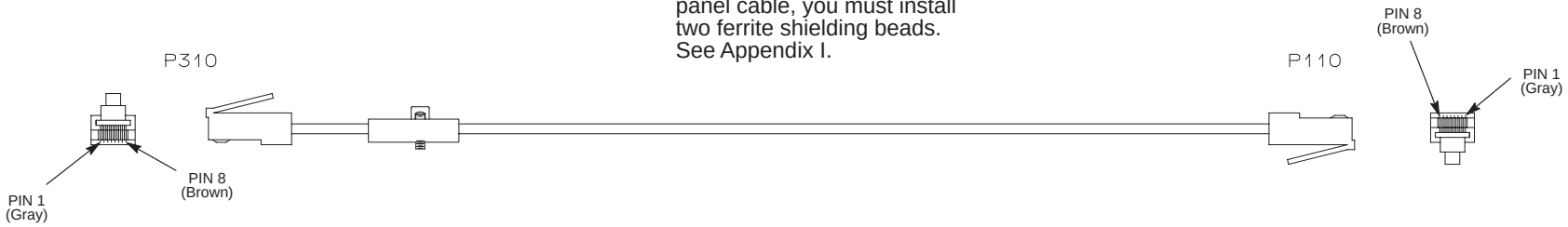
Part No.	Description
14H5289	Cable Assembly, AC Power Input



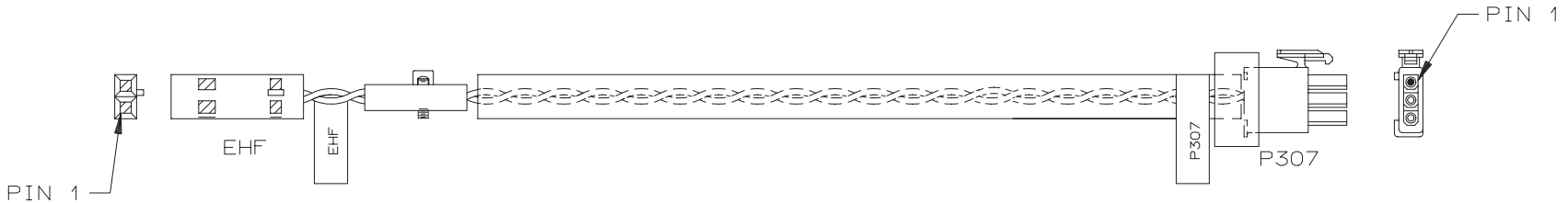
WIRE TABLE		
CCF	P306	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

Part No.	Description
14H5285	Cable Assembly, Card Cage Fan

IMPORTANT:
If you replace the control panel cable, you must install two ferrite shielding beads. See Appendix I.

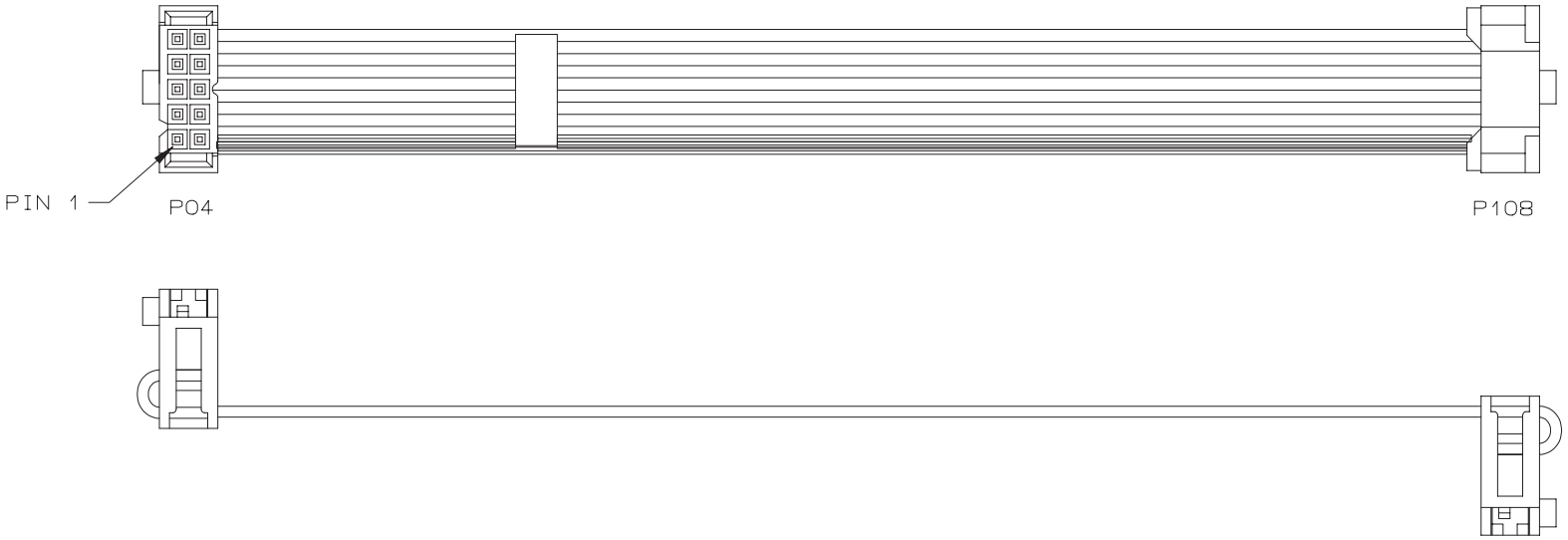


Part No.	Description
14H5300	Cable Assembly, Operator Panel

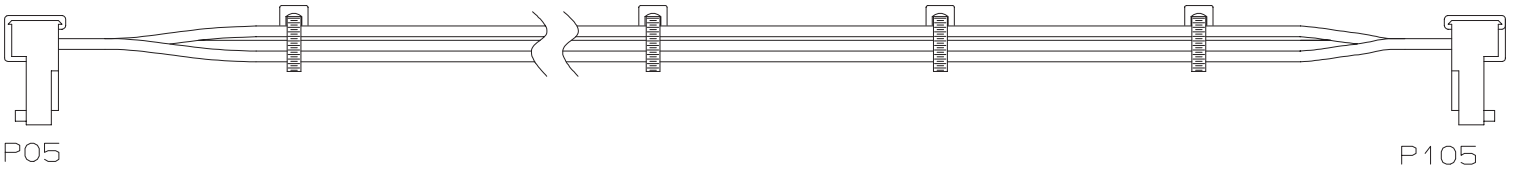


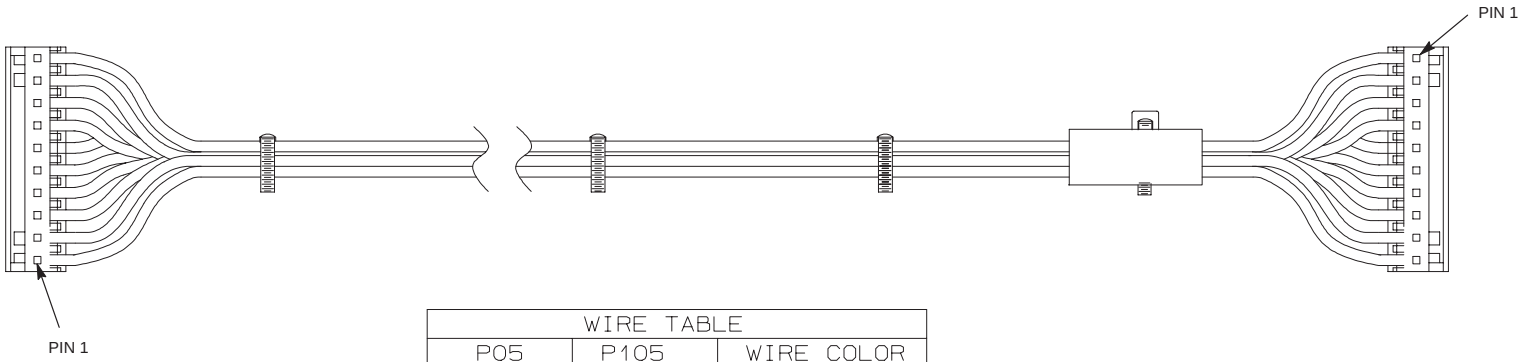
WIRE TABLE		
EHF	P307	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

Part No.	Description
14H5286	Cable Assembly, Exhaust Fan



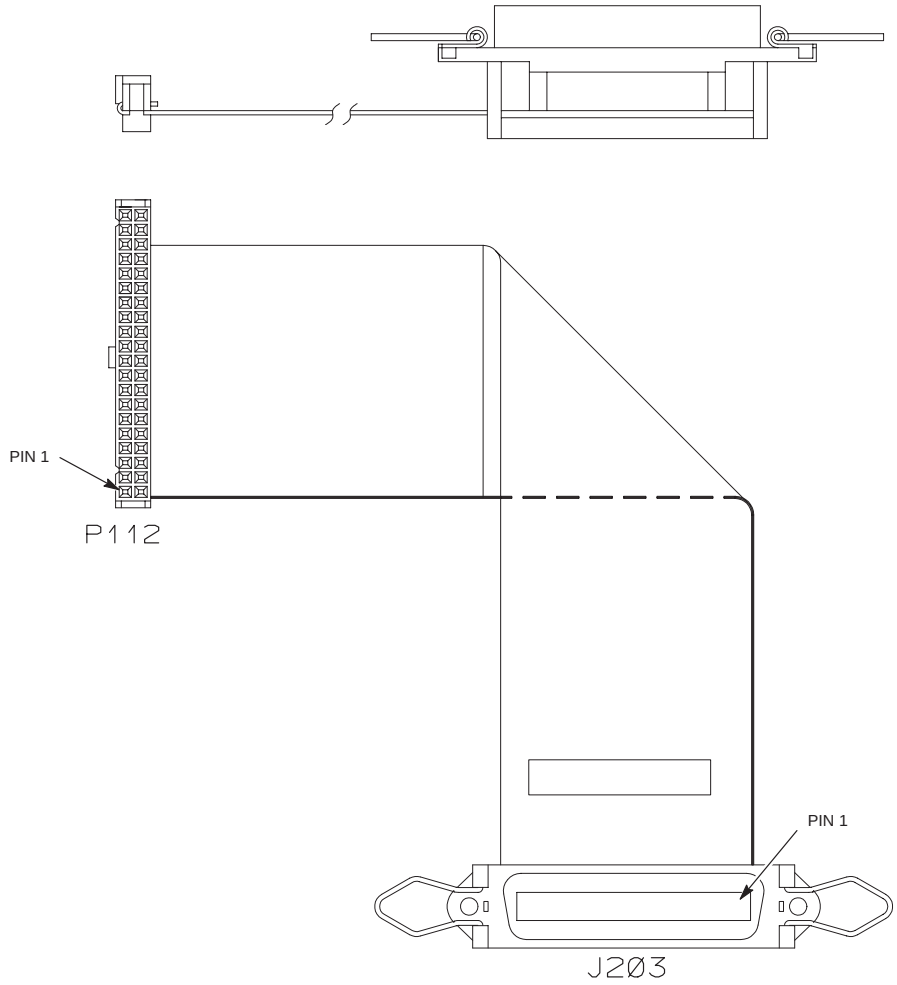
Part No.	Description
14H5279	Cable Assembly, Hammer Bank Logic





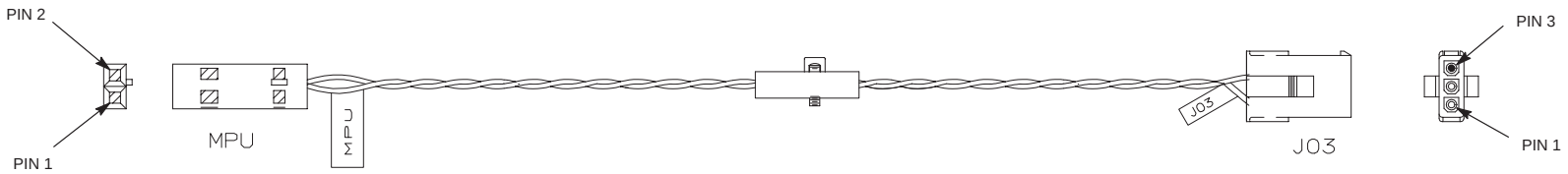
WIRE TABLE		
P05	P105	WIRE COLOR
2	1	GRAY
1	2	BLACK
4	3	GRAY
3	4	BLACK
6	5	GRAY
5	6	BLACK
8	7	GRAY
7	8	BLACK
10	9	GRAY
9	10	BLACK

Part No.	Description
14H5283	Cable Assembly, Hammer Bank Power



NOTE:
If you replace the I/O cable assembly, you must install the ferrite clamp.
See Appendix I.

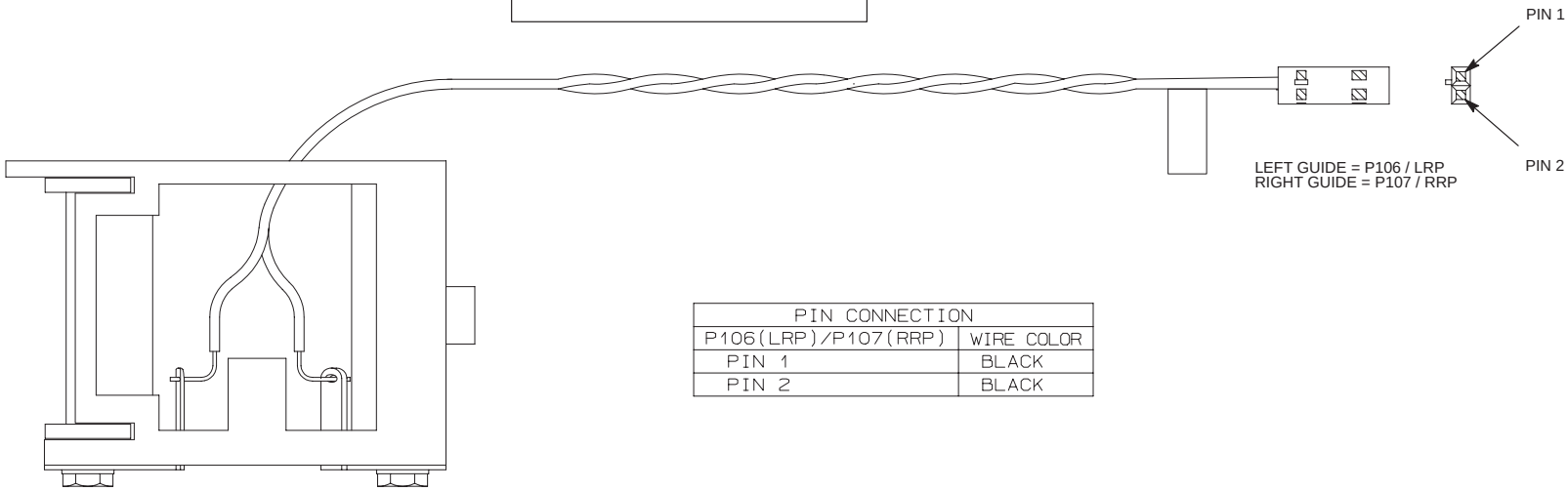
Part No.	Description
14H5287	Cable Assembly, I/O, Centronics



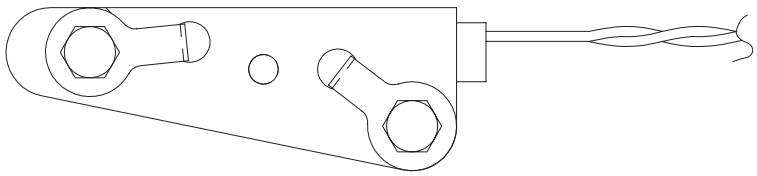
WIRE TABLE		
MPU	J03	WIRE COLOR
1	1	BLACK
2	2	GRAY
	3	N/C

Part No.	Description
14H5329	Cable Assembly, MPU

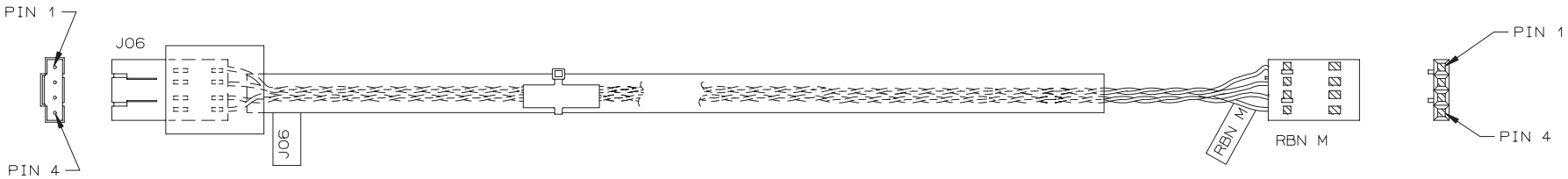
NOTE: Left ribbon guide shown. Right is mirror image.



PIN CONNECTION	
P106(LRP)/P107(RRP)	WIRE COLOR
PIN 1	BLACK
PIN 2	BLACK

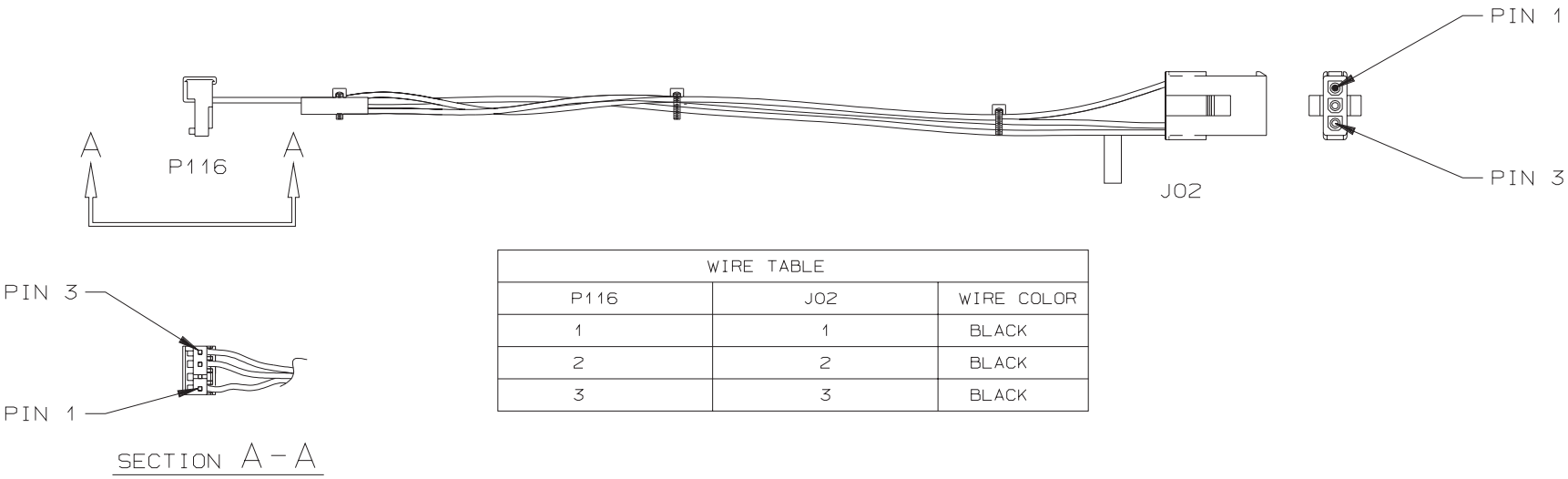


Part No.	Description
24H8894	Ribbon Guide Kit (Includes left and right guides)



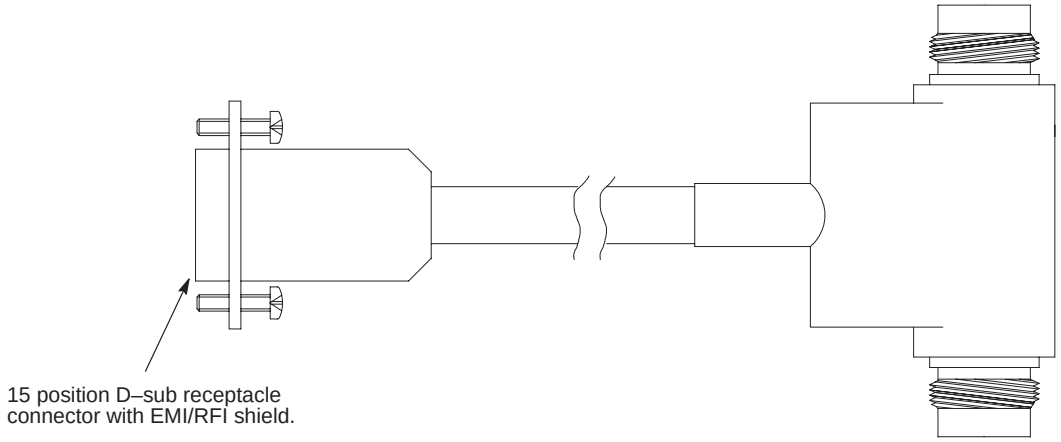
PIN CONNECTION		
J06	RBN M	WIRE COLOR
PIN 1	PIN 1	BROWN
PIN 2	PIN 2	ORANGE
PIN 3	PIN 3	RED
PIN 4	PIN 4	YELLOW

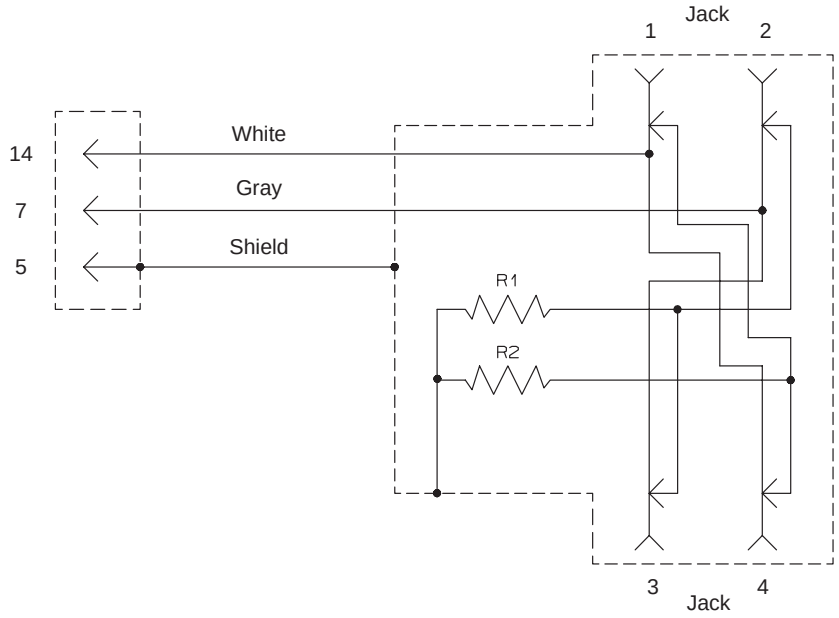
Part No.	Description
63H7464	Cable Assembly, Ribbon Motor, Extension

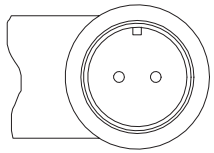


WIRE TABLE		
P116	J02	WIRE COLOR
1	1	BLACK
2	2	BLACK
3	3	BLACK

Part No.	Description
14H5330	Cable Assembly, Shuttle Motor Drive



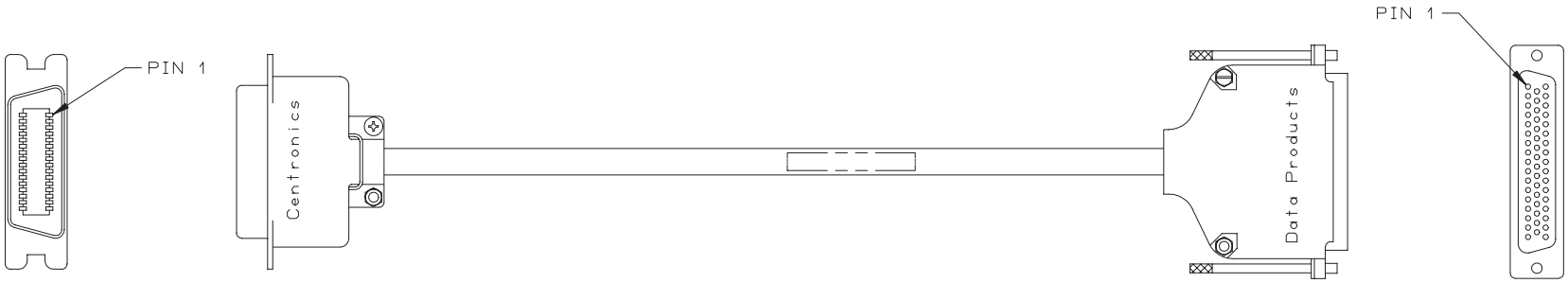




Resistance Chart

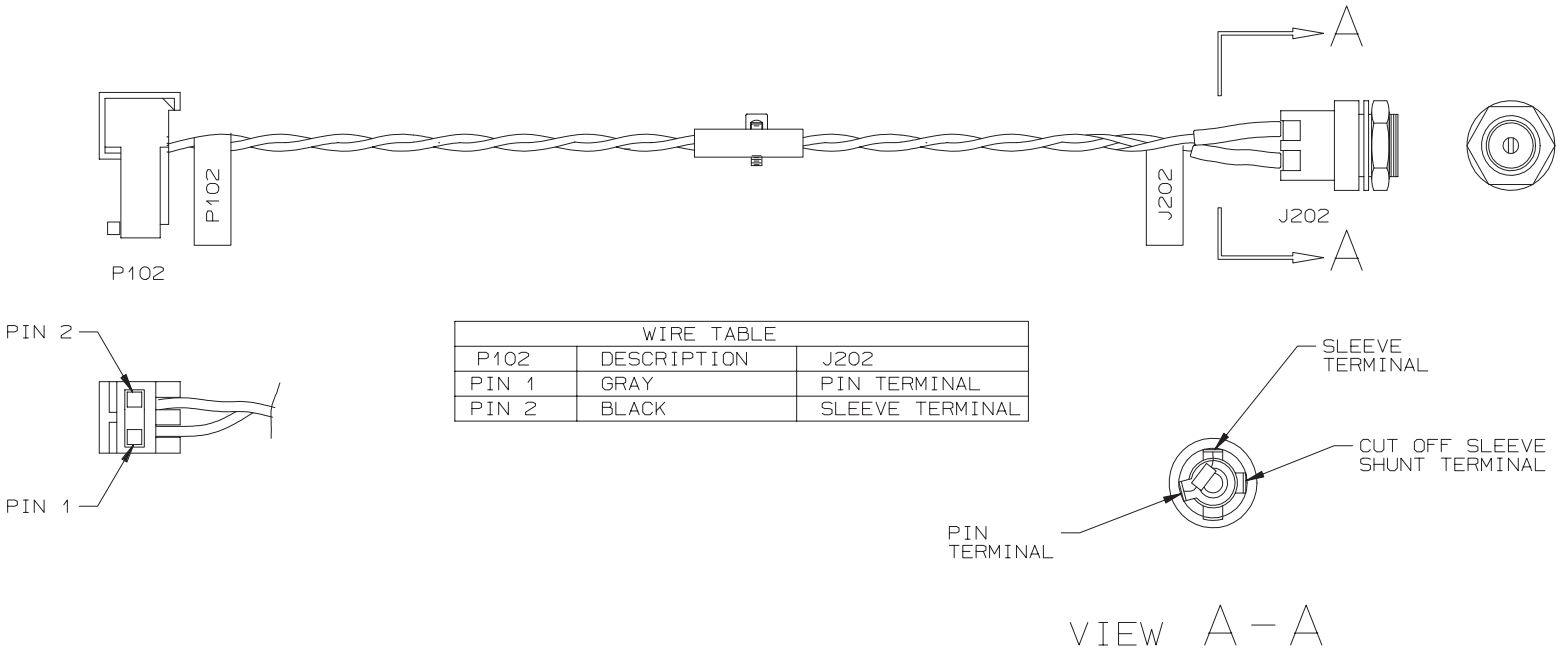
Pin	Pin	Ohms
1	2	110
3	4	110
1, 2, 3, 4	Shield	55
5	Shield	0
14	1, 4	0
7	2, 3	0

Part No.	Description
38F8254	Cable Assembly, Twinax Auto–Termination



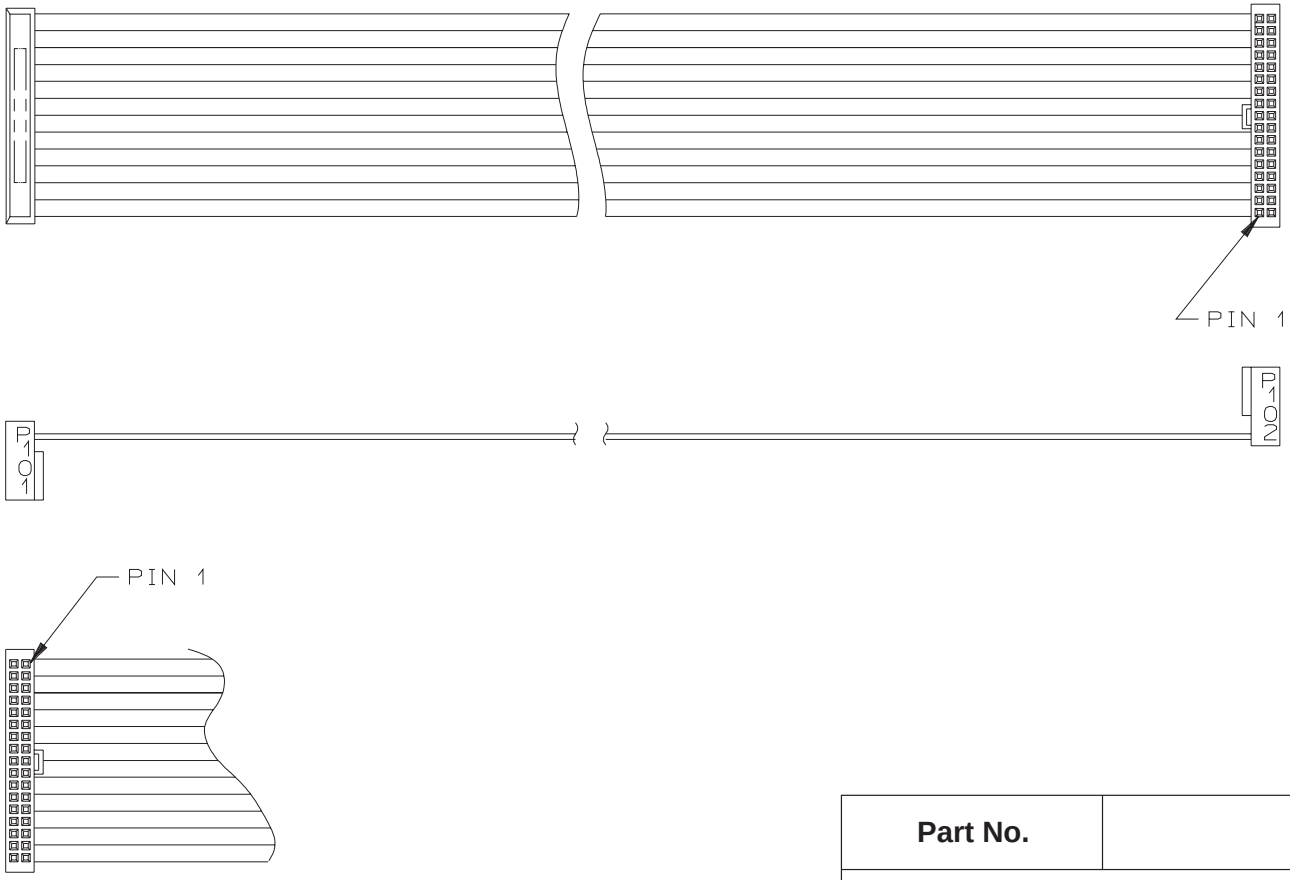
WIRING TABLE		
CENTRONICS	TWISTED PAIR	DATAPRODUCTS
PIN 1	#1	PIN 38
✳ PIN 19		✳ PIN 37
PIN 2	#2	PIN 19
✳ PIN 20		✳ PIN 3
PIN 3	#3	PIN 20
✳ PIN 21		✳ PIN 4
PIN 4	#4	PIN 1
✳ PIN 22		✳ PIN 2
PIN 5	#5	PIN 41
✳ PIN 23		✳ PIN 40
PIN 6	#6	PIN 34
✳ PIN 24		✳ PIN 18
PIN 7	#7	PIN 43
✳ PIN 25		✳ PIN 42
PIN 8	#8	PIN 36
✳ PIN 26		✳ PIN 35
PIN 9	#9	PIN 28
✳ PIN 27		✳ PIN 44
PIN 10	#10	PIN 23
✳ PIN 28		✳ PIN 7
PIN 12	#11	PIN 22
✳ PIN 30		✳ PIN 6
PIN 13	#12	PIN 21
✳ PIN 29		✳ PIN 5
PIN 15	#13	PIN 30
✳ PIN 33		✳ PIN 14
PIN 31	#14	PIN 31
✳ PIN 16		✳ PIN 15
✳ PIN 16,35	#15	✳ PIN 11,27
✳ PIN 17		✳ PIN 39
	JUMPER WIRE	PIN 45
✳ GROUND		✳ PIN 46

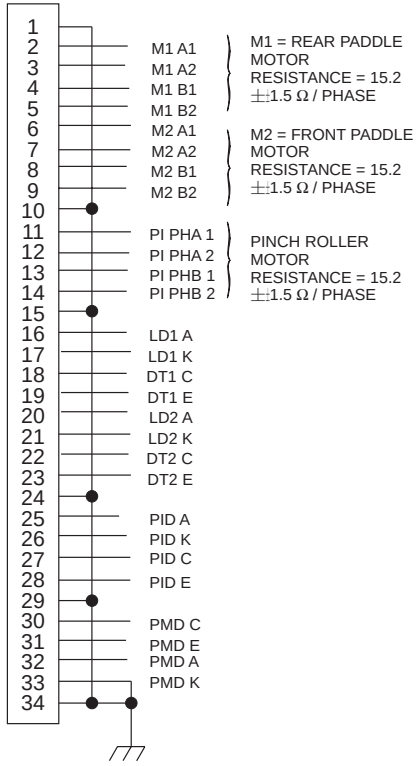
Part No.	Description
14H5522	Cable Assembly, Centronics/DataProducts Adapter



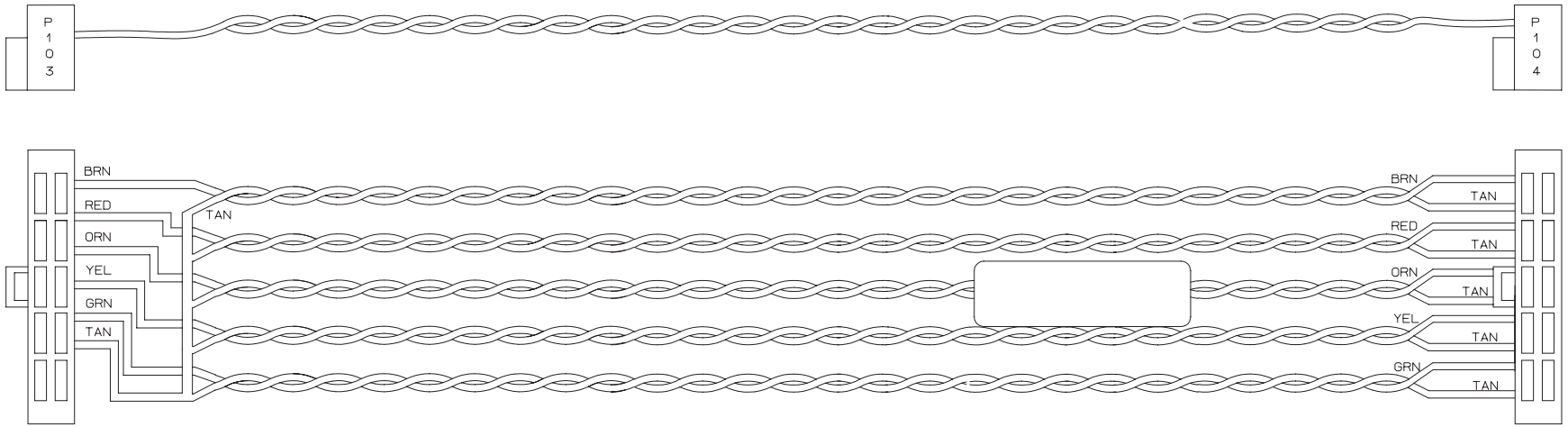
WIRE TABLE		
P102	DESCRIPTION	J202
PIN 1	GRAY	PIN TERMINAL
PIN 2	BLACK	SLEEVE TERMINAL

Part No.	Description
14H5589	Cable Assembly, +5V Remote Power





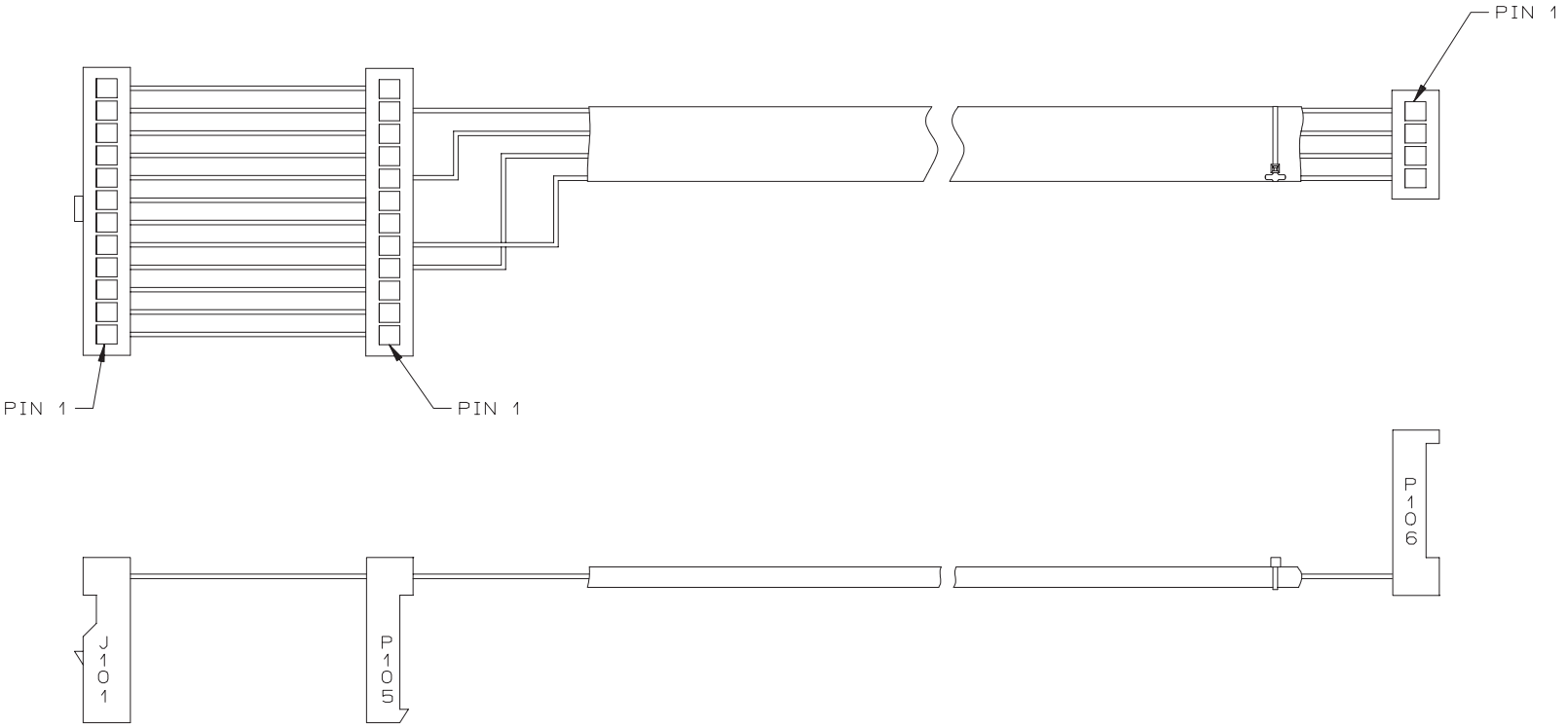
Part No.	Description
24H8973	Cable, Frame, Power Stacker



TWISTED PAIR COLOR CODING		
PAIR	LINE	COLOR
1	1	BRN
	2	TAN
2	3	RED
	4	TAN
3	5	ORN
	6	TAN
4	7	YEL
	8	TAN
5	9	GRN
	10	TAN

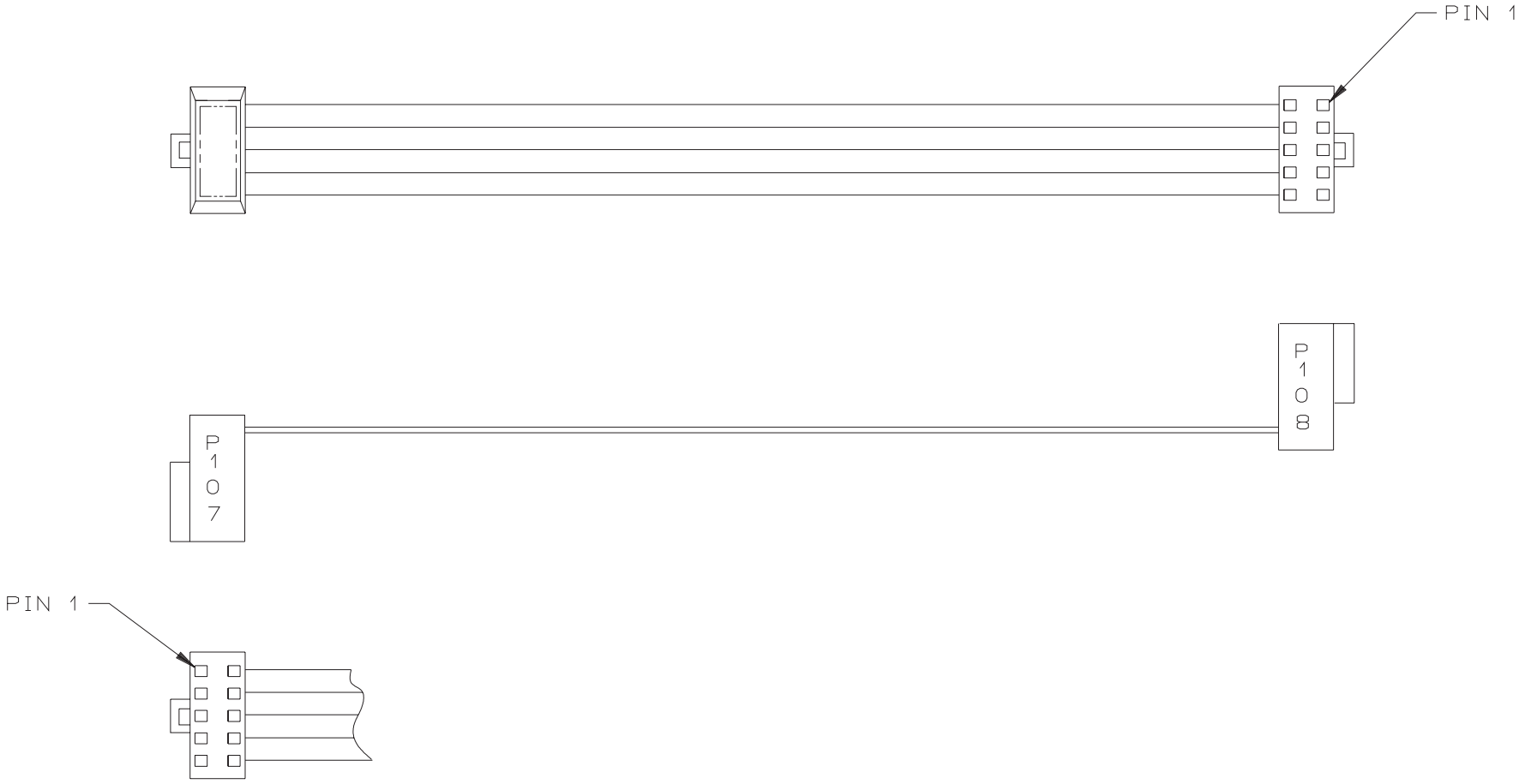
CONNECTION TABLE			
P103	LINE	P104	LINE
PIN 1	1/BRN	PIN 1	1/BRN
PIN 2	3/RED	PIN 2	2/TAN
PIN 3	5/ORN	PIN 3	3/RED
PIN 4	7/YEL	PIN 4	4/TAN
PIN 5	9/GRN	PIN 5	5/ORN
PIN 6	2,4,6,8,10	PIN 6	6/TAN
PIN 7	N/C	PIN 7	7/YEL
PIN 8	N/C	PIN 8	8/TAN
PIN 9	N/C	PIN 9	9/GRN
PIN 10	N/C	PIN 10	10/TAN

Part No.	Description
24H8976	Cable, Logic, Power Stacker

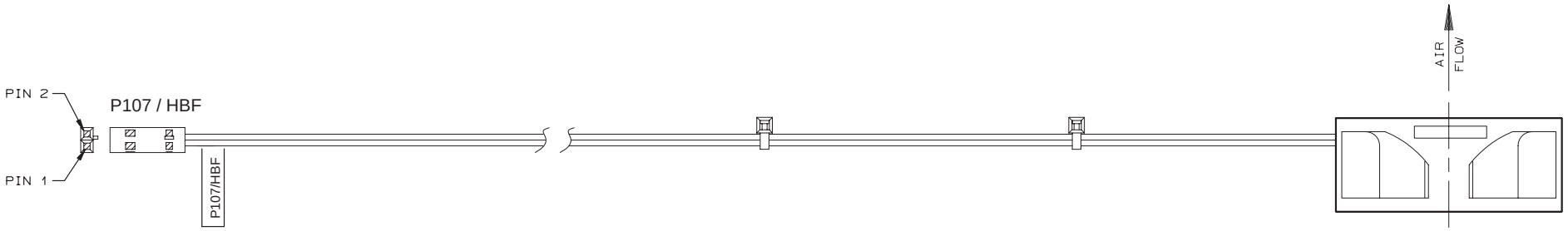


CONNECTION TABLE			
J101	P105	P105	P106
PIN 1	PIN 1	PIN 11	PIN 1
PIN 2	PIN 2	PIN 8	PIN 2
*	*	PIN 4	PIN 3
*	*	PIN 5	PIN 4
*	*		
PIN 11	PIN 11		
PIN 12	PIN 12		

Part No.	Description
24H8975	Cable, Power, Power Stacker

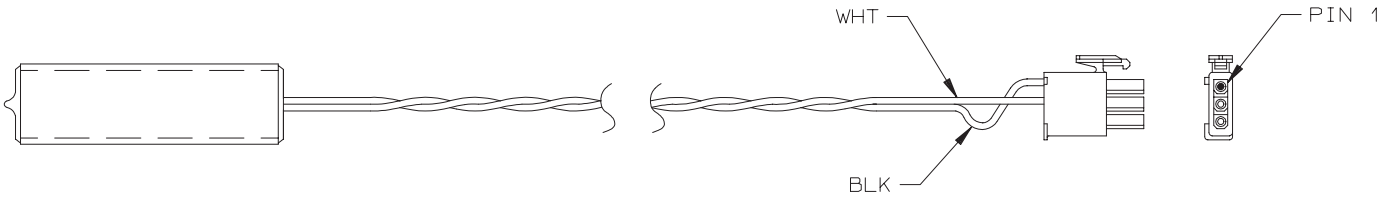


Part No.	Description
24H8964	Cable, Vertical Rail, Power Stacker



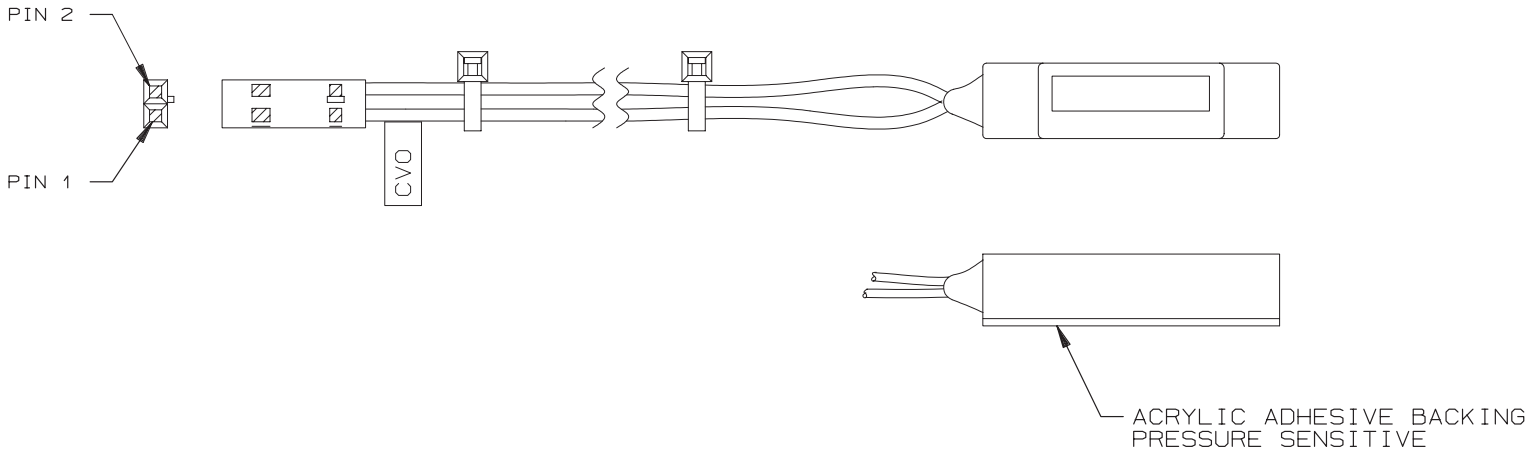
WIRE TABLE		
P107	POLARITY	HBF(J)
PIN 2	-	BLACK
PIN 1	+	RED

Part No.	Description
14H5159	Fan Assembly, Hammer Bank

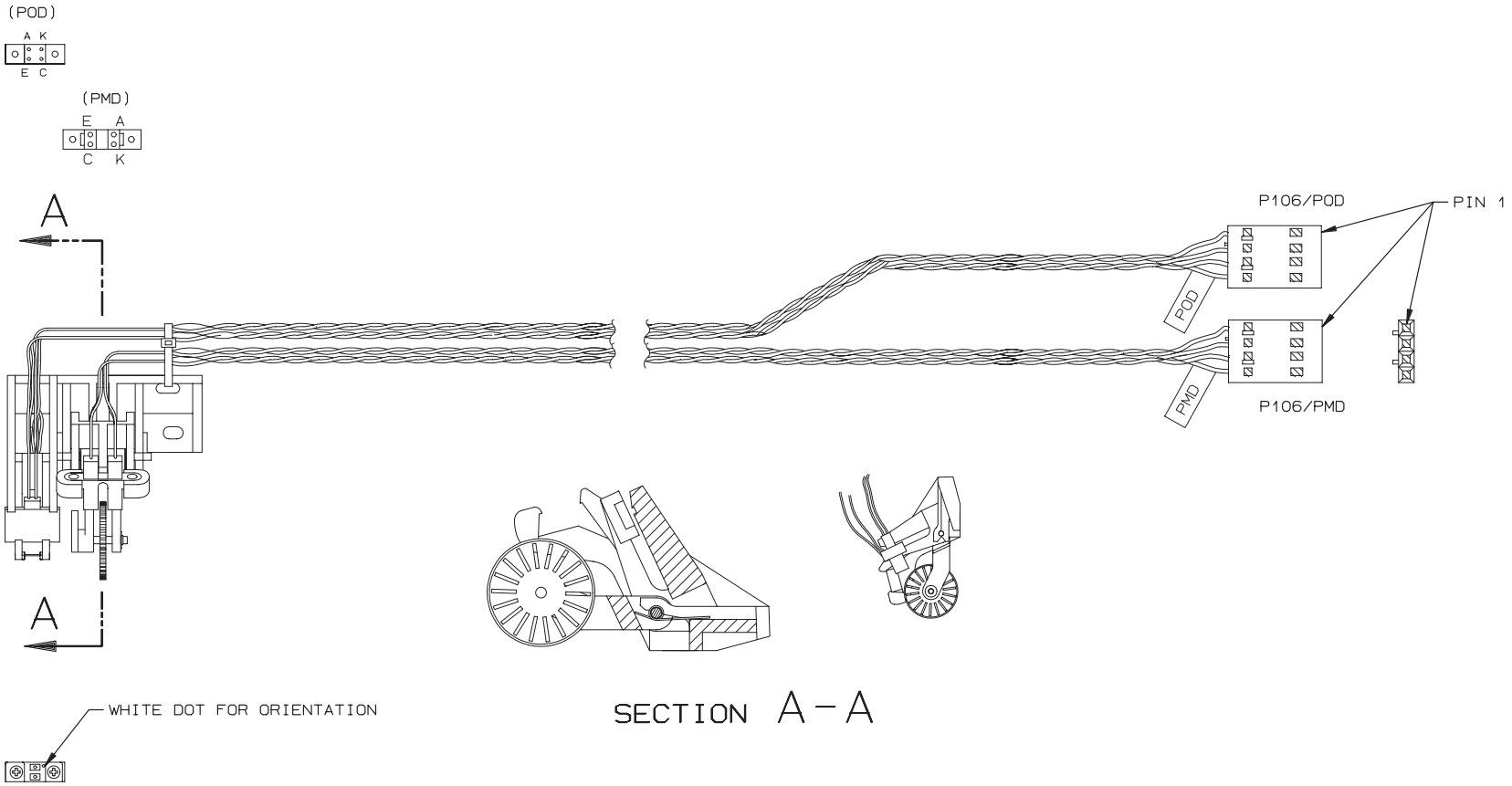


WIRE TABLE	
CONN PIN NO.	WIRE COLOR
1	BLACK
2	WHITE
3	N/C

Part No.	Description
57G1476	Magnetic Pickup Assembly

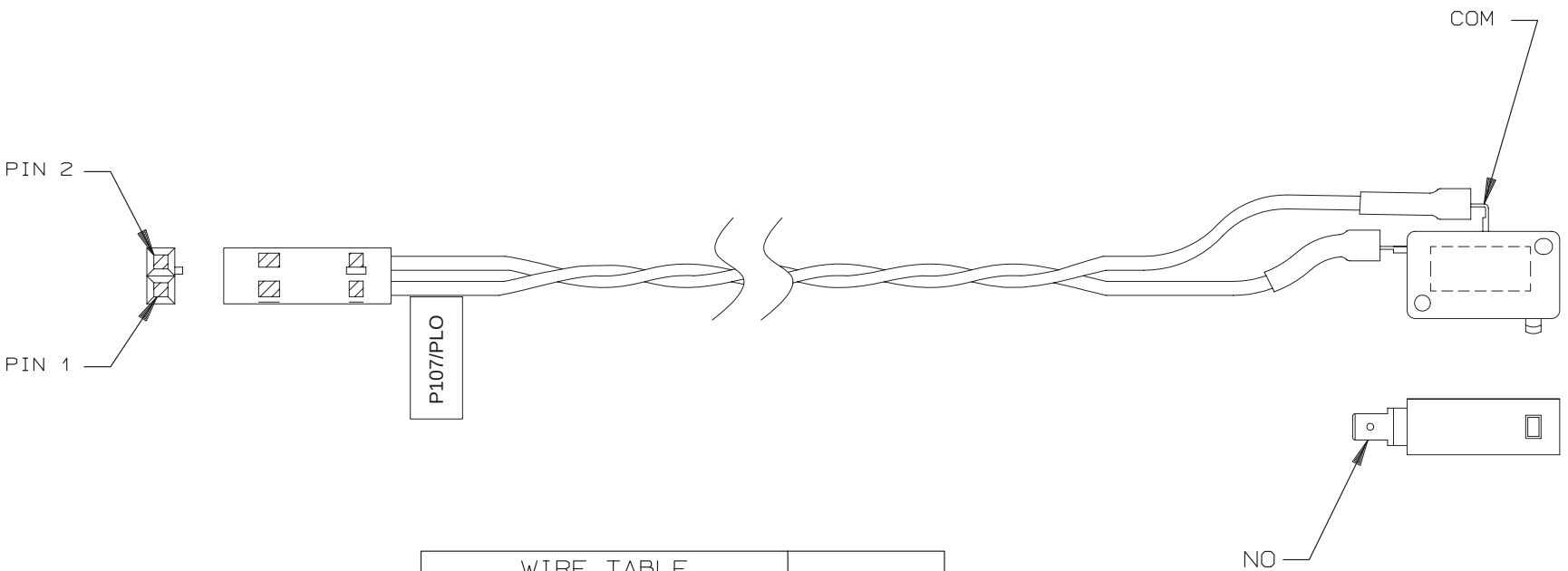


Part No.	Description
14H5282	Switch Assembly, Cover Open



WIRE TABLE				
P106/POD	P106/PMD	POD	PMD	CABLE
PIN 1		PIN E		BLACK
PIN 2		PIN C		GRAY
PIN 3		PIN K		WHITE
PIN 4		PIN A		RED
	PIN 1		PIN A	BLACK
	PIN 2		PIN K	BROWN
	PIN 3		PIN C	ORANGE
	PIN 4		PIN E	RED

Part No.	Description
14H5281 (63H5133)	Switch Assembly, Paper Detector (Standard) (Black Back Forms Kit, 6400)



WIRE TABLE		WIRE COLOR
PIN NO.	INTERLOCK SWITCH	
PIN 1	COM	BLACK
PIN 2	NO	GRAY

Part No.	Description
14H5280	Switch Assembly, Platen Interlock

B Printer Specifications

Ribbon Specifications

NOTE: The ribbon life figures listed below are based on IBM tests conducted in accordance with ANSI Standard X3A.182. Actual ribbon life may vary, depending on the user's quality criteria, printer condition, machine settings, paper quality, and bar code requirements. Label yield depends on label format, bar code symbology, and other parameters. Label yield with high-performance scanning equipment may exceed these yields. Use only the ribbons listed below.

IBM General Purpose Ribbon P/N 1040990
Used for general text printing such as data and word processing.
Average yield: 20 million DP characters

IBM General Purpose Ribbon P/N 1040995
Average yield: 30 million DP characters

IBM High Contrast Ribbon P/N 1040993
Used for general text printing as well as OCR, graphics and bar code printing.
Average yield: 20 million DP characters, 2500 AIAG–B3 labels with visible light source scanning equipment, or 1300 AIAG–B3 labels with infrared light source scanning equipment.

IBM High Contrast Ribbon P/N 1040998
Average yield: 30 million DP characters, 3600 AIAG–B3 labels with visible light source scanning equipment, or 1800 AIAG–B3 labels with infrared light source scanning equipment.

Ordering Ribbons (U.S. Only)

Ribbons may be purchased from Lexmark Authorized IBM Supplies Dealers or directly from Lexmark by calling: **1–800–438–2468**.

Fax orders may be sent to: **1–800–522–3422**
Mail orders may be sent to: Lexmark International, Inc., 1221 Alverser Drive, Midlothian, VA 23113.

Ordering Ribbons (Outside of U.S.)

Order supplies by contacting your local Lexmark International distributor or by writing to Lexmark International, Inc.
Lexmark International, Inc.
P.O. Box 11427
Lexington, KY, 40575–1427 USA

Paper Specifications

NOTE: The following paper specifications are general guidelines. Paper stock should be tested with applications to determine print quality.

Paper

Type: Edge-perforated, fan-fold, 3 to 17 inches (7.62 to 43.18 cm) wide*, 2 to 24 inches (5.08 to 60.96 cm) long**

- Single-part: 15 pound (57 g/m^2) to 100 pound (377 g/m^2) stock.
- Multi-part carbon: 1- to 6-part forms, maximum 12 pound (45 g/m$^{2)}$ ply of upper plies
- Multi-part carbonless. Verify readability of greater than 4-part.

Thickness: 0.025 inches (0.064 cm) maximum

Drive: Adjustable tractors, 6-pin engagement

Slew Rates:	Fast	Slow
6400–004, –04P	12 ips	8 ips
6400–005, –05P	12 ips	8 ips
6400–050, –P50	12 ips	10.4 ips
6400–008, –08P	16 ips	8 ips
6400–09P	16 ips	8 ips
6400–009	20 ips	10 ips
6500–P10	16 ips	10.4 ips
6500–010	20 ips	10.4 ips
6400–012	20 ips	10 ips
6400–014	20 ips	10 ips
6400–015	25 ips	10.4 ips

Labels

On Backing: One-part continuous perforated fan-fold back form. Labels must be placed at least 1/6 inch (0.42 cm) from the fan-fold perforation. Backing adhesive must not be squeezed out during printing.

Sheet Size: 3 to 17 inches (7.62 to 43.18 cm) wide*, including the two standard perforated tractor feed strips. A maximum sheet length of 16 inches (40.64 cm) between top and bottom perforations.**

Thickness: Not to exceed 0.025 inch (0.064 cm), including backing sheet.

* On pedestal models, when using the rear paper exit, the maximum width is 16 inches (40.64 cm).

** On cabinet models, forms longer than 12 inches (30.48 cm) can be used by opening the front and rear printer doors.

Printer Dimensions

	Cabinet Model	**Pedestal Model**
Height:	42.5 inches (108 cm)	35.5 inches (90.2 cm)
Width:	27 inches (68.6 cm)	24.6 inches (62.5 cm)
Depth:	29 inches (73.7 cm)	30 inches (76.2 cm)
Weight:	225 lbs. (102.1 kg) 285 lbs. (129.3 kg) packaged	120 lbs. (54.4 kg) 160 lbs. (72.6 kg) packaged

Environmental Characteristics

Temperature

Operating	41° to 104° F (5° to 40° C) up to 5000 feet (1524 meters) 41° to 90° F (5° to 32° C) up to 8000 feet (2438 meters)
Storage	–40° to 158° F (–40° to 70° C)

Relative Humidity

Operating	15% to 80% (noncondensing)
Storage	15% to 90% (noncondensing)

ENERGY STAR

IBM 6400 Series Printers comply with the requirements of the ENERGY STAR Computers Program of the U.S. Environmental Protection Agency.

Electrical Characteristics

Input Voltage

Line Voltage Design Range	Line Frequency	RMS Current								
		–04, –04P	–05, –05P	–50, –P50	–08, –08P	–09, –09P	–010, –P10	–012	–014	–015
88–135V RMS	47–63 Hz	6A @ 100 V	6A @ 100 V	6A @ 88 V	6A @ 100 V	6A @ 100 V	6A @ 88 V	6A @ 100 V	8A @ 100 V	8A @ 88 V
178–270V RMS	47–63 Hz	3A @ 200 V	3A @ 200 V	3A @ 178 V	3A @ 200 V	3A @ 200 V	3A @ 178 V	4A @ 200 V	5A @ 200 V	5A @ 178 V

Power Consumption

6400–004
6400–04P

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	200	165	70	25
BTU/Hour	680	560	240	85
VA	350	290	130	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	180	150	60	25
BTU/Hour	615	510	205	85
VA	390	310	145	55

6400–005
6400–05P

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	200	165	70	25
BTU/Hour	680	560	240	85
VA	350	290	130	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	180	150	60	25
BTU/Hour	615	510	205	85
VA	390	310	145	55

6400–050
6400–P50

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	210	180	80	21
BTU/Hour	720	620	275	75
VA	300	270	120	36

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	210	170	80	22
BTU/Hour	720	580	275	75
VA	340	280	130	41

6400–008
6400–08P

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	240	190	70	25
BTU/Hour	820	650	240	85
VA	415	330	130	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	210	180	60	25
BTU/Hour	720	615	205	85
VA	435	360	145	55

6400–009
6400–09P

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	290	225	80	25
BTU/Hour	990	770	275	85
VA	500	380	140	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	280	220	75	25
BTU/Hour	960	750	255	85
VA	550	440	150	55

6400–010
6400–P10

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	300	240	80	25
BTU/Hour	1025	820	275	85
VA	530	400	140	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	290	230	80	25
BTU/Hour	990	790	275	85
VA	600	450	150	55

6400–012

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	290	215	70	25
BTU/Hour	990	735	240	85
VA	490	370	130	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	280	200	60	25
BTU/Hour	960	615	205	85
VA	550	410	145	55

6400–014

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	370	260	75	25
BTU/Hour	1260	885	255	85
VA	635	445	130	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	380	255	75	25
BTU/Hour	1300	870	255	85
VA	710	485	150	55

6400–015

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	440	330	90	27
BTU/Hour	1500	1130	310	92
VA	740	550	160	50

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	420	320	90	27
BTU/Hour	1440	1095	310	92
VA	8300	600	170	58

6400–XXK

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	370	260	75	25
BTU/Hour	1260	885	255	85
VA	635	445	130	48

230 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	Max Typical	Not Energy Star	Energy Star
Watts	380	255	75	25
BTU/Hour	1300	870	255	85
VA	710	485	150	55

Interfaces

Type:	PC Parallel, RS–232 serial, RS–422 serial
Logic Levels:	TTL, EIA–232E, EIA–422B
Data Format:	ASCII
Compatibility:	PC Parallel, EIA–232E serial, EIA–422B serial
Transfer Rates:	Up to 200 Kilobytes on parallel interface Up to 115.2K baud on RS–232/422 serial interface

Duty Cycle

6400–004, 04P	130, 000 pages per month
6400–005, 05P	130, 000 pages per month
6400–050, P50	130, 000 pages per month
6400–008, 08P	205, 000 pages per month
6400–009, 09P	205, 000 pages per month
6400–010, P10	205, 000 pages per month
6400–012	320, 000 pages per month

6400–014 376, 000 pages per month
6400–015 376, 000 pages per month
—under the following conditions:

- Uppercase text characters only (no graphics)
- 6 lines per inch
- 10 characters per inch
- 63% character density or 83 characters per line
- 63% line density or 42 lines per 11-inch page
- Single part (18 lb) paper
- Printer is installed in accordance with the *Setup Guide*
- Printer is maintained in accordance with this maintenance manual

Printing Rates

The printing speed of ASCII and Kanji/Hanzi characters is measured in lines per minute (lpm). The printing speed of text is a function of the selected font and the vertical dot density, and is independent of the number of characters configured in a character set repertoire. Print rates for lines containing attributes such as bold or emphasized printing, superscripts, subscripts, or elongated attributes will decrease to not less than half the rates of lines without such attributes. The exact print rate of lines containing these attributes depends on the specific print job, but software maximizes the throughput by dynamically determining which dot rows contain adjacent dots and must be printed in two strokes.

The printing speed of graphics (“plot mode”) is expressed in inches per minute (ipm). The printing rates of ASCII printers are shown in Table 6.

The reverse paper feed capability allows the printing of multiple densities on a single line. This is useful when printing forms and text together or for mixing fonts on the same print line. Use of multiple densities and reverse paper feed also affects throughput.

Table 6. Printing Rates

PRINT QUALITY / DOT DENSITY (DPI) NOTE 1	CHARACTERS PER INCH	DOT MATRIX NOTE 2	PERFORMANCE																	
			UPPERCASE ONLY LPM						DESCENDERS & UNDERLINE LPM						PLOT MODE IPM					
		MODEL	04 04P	05 05P	08 08P	09 09P	012	014	04 04P	05 05P	08 08P	09 09P	012	014	04 04P	05 05P	08 08P	09 09P	012	014
CORRESPONDENCE 90 (180) X 96	10 12 15	7 (13) X 9 + 3 6 (11) X 9 + 3 5 (9) X 9 + 3	190	200	320	350	480	560	147	154	247	270	370	432	20	21	33	36.5	50	58
DATA PROCESSING 60 (120) X 72	10 12 13.3 15 17.1	5 (9) X 7 + 2 4 (7) X 7 + 2 4 (7) X 7 + 2 3 (5) X 7 + 2 3 (5) X 7 + 2	356	375	600	658	900	1050	285	300	480	527	720	840	40	42	67	73	100	117
HIGH SPEED 60 (120) X 48	10 12 13.3	5 (9) X 5 + 1 4 (7) X 5 + 1 4 (7) X 5 + 1	475	500	800	900	1200	1400	407	428	684	770	1026	1197	59	63	100	112	150	175

PRINT QUALITY / DOT DENSITY (DPI) NOTE 1	CHARACTERS PER INCH	DOT MATRIX NOTE 2	PERFORMANCE								
			UPPERCASE ONLY LPM			DESCENDERS & UNDERLINE LPM			PLOT MODE IPM		
		MODEL	050 P50	010 P10	015	050 P50	010 P10	015	050 P50	010 P10	015
CORRESPONDENCE 90 (180) X 96	10 12 15	7 (13) X 9 + 3 6 (11) X 9 + 3 5 (9) X 9 + 3	200	400	600	155	306	459	21	42	61
DATA PROCESSING 60 (120) X 72	10 12 13.3 15 17.1	5 (9) X 7 + 2 4 (7) X 7 + 2 4 (7) X 7 + 2 3 (5) X 7 + 2 3 (5) X 7 + 2	375	750	1125	300	600	900	42	83	127
HIGH SPEED 60 (120) X 48	10 12 13.3	5 (9) X 5 + 1 4 (7) X 5 + 1 4 (7) X 5 + 1	500	1000	1500	428	856	1284	62	124	186

NOTE 1 A (B) X C, where:

A is maximum horizontal dot density
B is horizontal dot placement density
C is vertical dot density

NOTE 2 D (E) X F + G, where:

D is maximum number of dots that may be placed on E horizontal dot positions
F is number of vertical dots for uppercase symbols
G is number of dots available for descenders

C Metric Conversion Tables

Length

Multiply	By	To Obtain
foot	0.3048*	meter
foot	30.48*	centimeter
foot	304.8*	millimeter
inch	0.0254*	meter
inch	2.54*	centimeter
inch	25.4*	millimeter
meter	3.280840	foot
centimeter	0.03280840	foot
millimeter	0.003280840	foot
meter	39.37008	inch
centimeter	0.3937008	inch
millimeter	0.03937008	inch
* Figure is exact		

Torque and Force

Multiply	By	To Obtain
pound-inch	0.11298	Newton-meter
pound-foot	1.3558	Newton-meter
Newton-meter	8.8511	pound-inch
Newton-meter	0.7376	pound-foot
pound	4.4482	Newton
inch	0.22481	pound

Mass and Density

Multiply	By	To Obtain
pound*	0.4535924	kilogram
ounce*	28.34952	gram
kilogram	2.204622	pound
gram	0.03527397	ounce
* avoirdupois		

Temperature

From	To	Use Formula
temperature Celsius (tc)	temperature Fahrenheit (tf)	tf = 1.8tc + 32
temperature Fahrenheit (tf)	temperature Celsius (tc)	tc = (tf –32)/1.8

Power

Multiply	By	To Obtain
Btu (International Table)/hour	0.2930711	Watt
Watt	3.412141	Btu (International Table)/hour
Watt	0.001359621	horsepower (metric)
horsepower (metric)	735.499	Watt

D Torque Table

The table below establishes the torque requirements for routine installation of threaded fasteners. These requirements apply to fasteners made of steel, at a minimum engagement of 3.5 threads, including chamfer and countersink. Fastener sizes are listed as Numbered Size – Threads Per Inch.

Torque Table

Carbon Steel Fasteners (ANSI B18.6.3 – 1972)				
Fastener Size	**Into Alum. or Brass** 25,000 psi ultimate tensile strength	**Into Steel** 60,000 psi ultimate tensile strength	**Into Weld/Press Studs or Nuts**	**Into Medium Carbon Steel Fasteners** 105,000 psi ultimate tensile strength
2–56	25 + 2 in oz	36 + 2 in oz	30 + 2 in oz	—
4–40	62 + 4 in oz	75 + 5 in oz	70 + 5 in oz	—
6–32	122 + 7 in oz	150 + 10 in oz	135 + 10 in oz	—
8–32	11 + 1 in lb	18 + 1 in lb	18 + 1 in lb	—
10–24	20 + 1 in lb	25 + 1.5 in lb	21 + 1 in lb	—
10–32	15 + 1 in lb	29 + 2 in lb	29 + 1 in lb	—
1/4 – 20	40 + 3 in lb	62 + 4 in lb	62 + 4 in lb	105 + 5 in lb

Fastener Size	**Torque for Routine Tightening of Threaded Fasteners**
4–40 UNC & 4–48 UNF	4 + 1 in lb
6–32 UNC & 6–40 UNF	11 + 1 in lb
8–32 UNC & 8–36 UNF	19 + 1 in lb
10–24 UNC & 10–32 UNF	25 + 1 in lb

E Safety Inspection Guide

Safety Inspections

IBM 6400 printers incorporate safety items installed to protect customers, operators, and service personnel from injury. Use this inspection guide as an aid in identifying possible unsafe conditions in a 6400 series printer.

Perform the inspection steps outlined in this guide before the normal inspection for Maintenance Agreement Qualification, or any time you are instructed to make a safety inspection.

If you find any unsafe conditions, determine the severity of the hazard and whether or not you can continue the inspection without first correcting the problem.

NOTE: The correction of any unsafe condition is the customer's responsibility.

Preparation

You must have completed the “Electrical Safety Training Course for IBM Customer Engineers” (self-study course 77170 or existing level) to do the Safety Inspection.

Have the following items available:

1. *Electrical Safety for IBM Customer Engineers*, Order No. S229–8124.
2. A Fluke** meter (P/N 8496278) or similar device for resistance and voltage measurements.
3. An ECOS** Electrical Safety Tester (P/N 6339695) in the United States or a similar safety tester in other countries.

For each safety check on the following pages, do the steps in the order presented. Do not omit any steps.

Prepare the Printer for Inspection

DANGER:

<3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.

<4> Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.

<5> Power off the printer and disconnect the power cord before connecting or disconnecting communication port, teleport, or attachment cable connector.

1. Have the operator take the printer off-line.
2. Power off the printer.
3. Unplug the printer power cord from the customer’s power outlet.

Inspect Mechanical Parts

Top Cover and Cabinet Doors

1. Inspect the top cover:
    a. Open the top cover. On cabinet models, make sure the gas spring assembly holds the cover up in the open position.
    b. Make sure the window is not cracked or broken.
    c. Make sure the seal around the top cover is not cracked or broken.
    d. Make sure there are no exposed or sharp edges.
    e. Make sure the wireform paper path is undamaged.
    f. Make sure the electrostatic discharge (ESD) fingers are not loose or damaged. Make sure they touch the contact strips on the frame when the cover is closed.
    g. Close the top cover. Make sure the operator panel is centered in the opening of the cover.
2. On cabinet models, inspect the front and rear cabinet doors:
    a. Make sure the seals and magnetic strips are not loose or damaged.
    b. Make sure the restraining cable is attached and unbroken.
    c. Make sure there are no exposed or sharp edges.
    d. Open the rear cabinet door and inspect the lower rear paper path:
    a. Make sure the service panel permitting access to the I/O plate and circuit breaker (on/off switch) is installed.
    b. Make sure the paper stacker tray assembly is in place and undamaged.

Print Mechanism

1. Open the printer top cover.
2. Make sure the shuttle cover is correctly installed and undamaged. (See page 209.)
3. Make sure the paper path is correctly installed and undamaged. (See page 235.)

Safety Ground Path

1. Make sure the printer power cord is unplugged.
2. Remove the paper guide assembly (page 235).
3. Make sure the ground cable from the circuit breaker power leads is undamaged and firmly attached to the ground lug on the wall of the card cage, as shown in Figure 54.

NOTE: Ground paths for the entire printer are summarized in Figure 55.

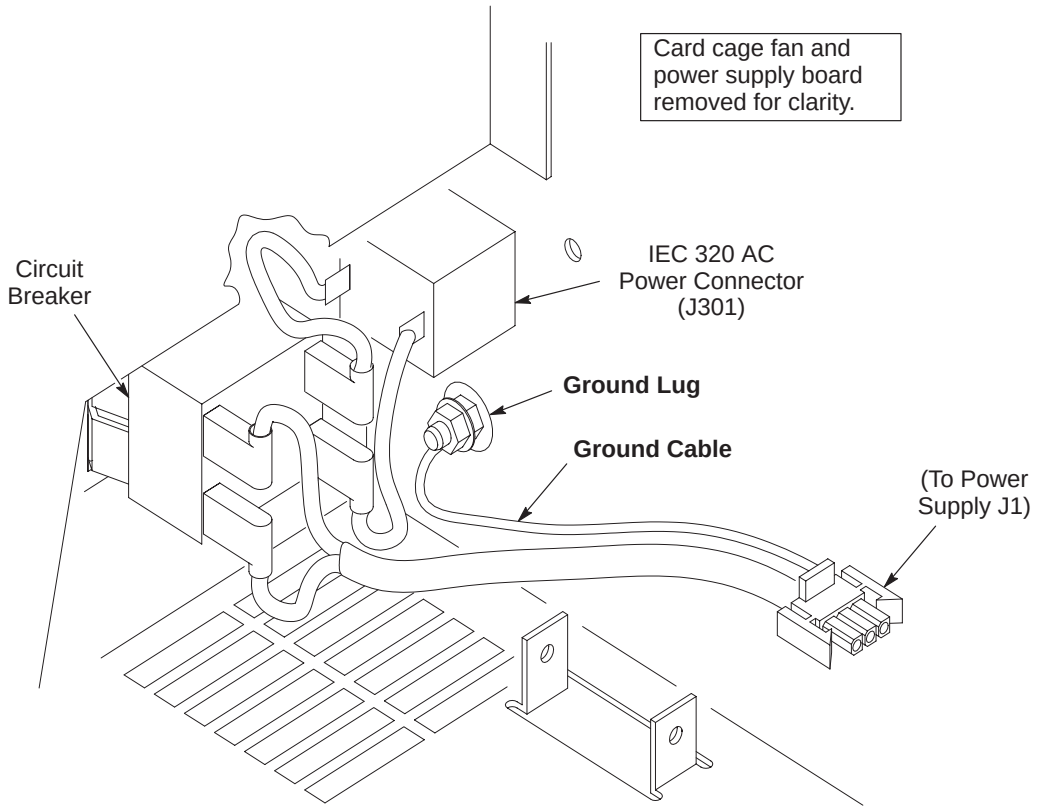

Card cage fan and power supply board removed for clarity.
Circuit Breaker
IEC 320 AC Power Connector (J301)
Ground Lug
Ground Cable
(To Power Supply J1)

Figure 54. Circuit Breaker Ground, Cabinet Models

4. Set a Fluke meter (P/N 8496278) or similar device to the lowest resistance scale. Measure the resistance between the power cable ground pin and the printer frame: safety ground circuits should measure 0.1 Ohm or less.

5. Install the paper guide assembly (page 235).

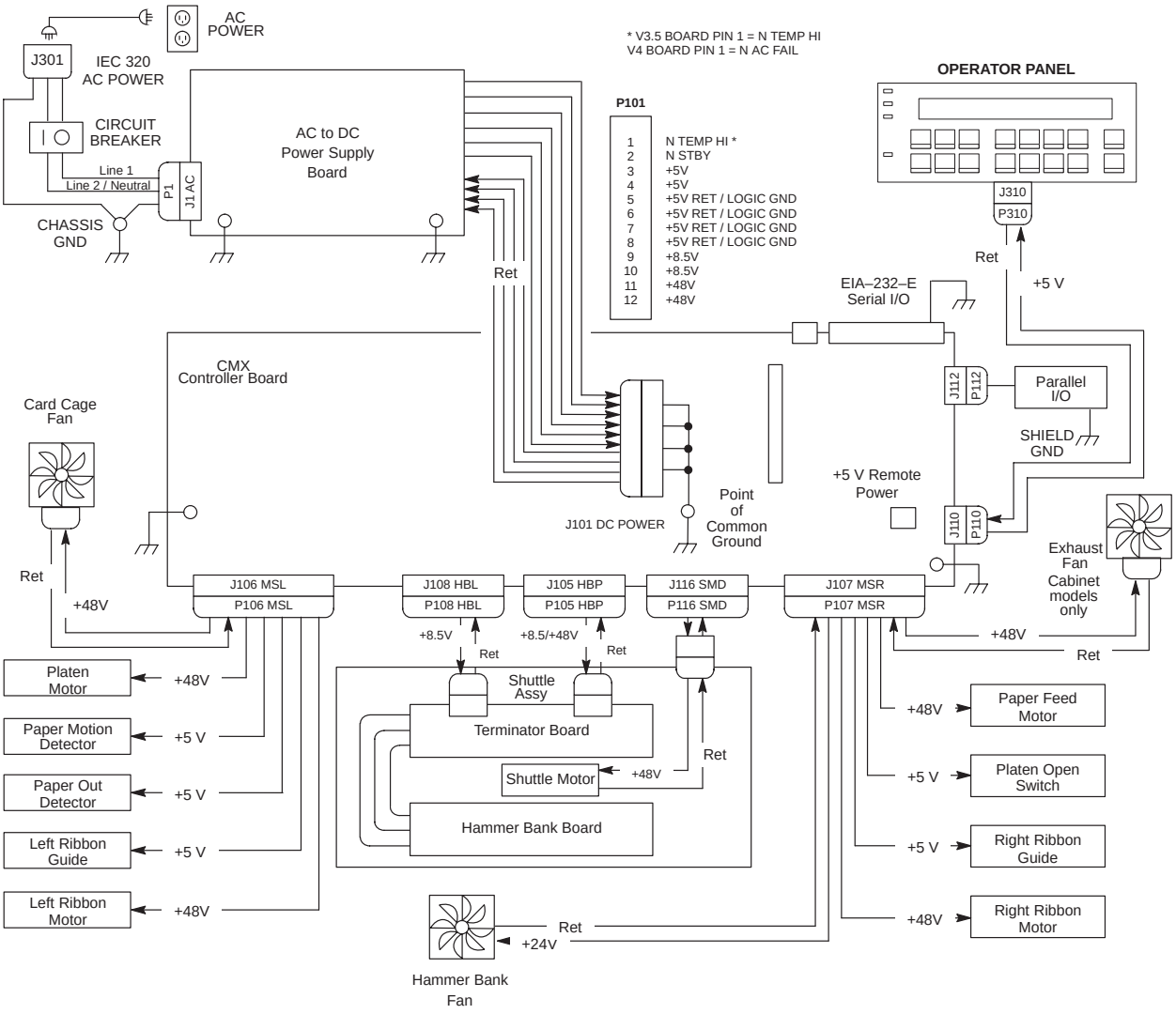


Figure 55. Ground Path Diagram

Customer Power Source Service Check

Use an ECOS Electrical Safety Tester (P/N 6339695) in the United States or a similar safety tester in other countries.

NOTE: The ECOS tester will trip ground fault detector protected outlets. This is a good test of the ground fault detector. Reset the outlet as needed.

Plug the ECOS meter into the customer's outlet. Follow the instructions supplied with the meter to test for the following:

1. Wiring errors
2. Low voltage
3. Neutral to ground short
4. Ground path impedance
5. Neutral impedance

NOTE: The customer is responsible for correcting problems with the power source. Inform the IBM Installation Planning Representative (IPR) of any problems with the customer's power source.

Each branch circuit must be grounded for safety and correct operation of the printer. This ground must be connected either to the electrical service ground or to a suitable building ground. The printer power cable has a green or green/yellow insulated grounding conductor. This is *not* a neutral.

Power Cable

1. Make sure the power cable is not damaged.
2. Make sure the power plug is the correct type.

Power On/Off Verification

1. Make sure all covers are installed.
2. Plug the power cable into the customer's power outlet.
3. Power on the printer and watch the LCD.
4. Verify that the power on diagnostic tests and initialization routines are successful.
5. After successful initialization, the printer should cycle automatically to either the READY or NOT READY mode, depending on which power on state was selected when the printer was configured.
6. Power off the printer. Verify that the LCD goes completely blank and all fans stop.

Print Interlock Service Check

1. Power on the printer.
2. Open the printer top cover.
3. Open the forms thickness lever.
   The LCD should display "057 CLOSE PLATEN" and the audible alarm should sound if it is enabled.
4. Press **Stop**. The audible alarm should stop.
5. Close the forms thickness lever. The fault message should clear.

F Abbreviations and Signal Mnemonics

NOTE: Mnemonics with the first letter “N” are negative true.

Abbreviation/ Mnemonic	Definition
μF	microfarad (10^{-6} farad)
μs	microsecond (10^{-6} second)
μsec	microsecond (10^{-6} second)
A0, A1, etc.	Address 0, Address 1, etc.
AC	Alternating Current
ACC	Access
ACK	Acknowledge
AMP	Amplitude; Ampere
AMPL	Amplitude
AN	Anode
ASIC	Application-Specific Integrated Circuit
ATTN	Attention
B	Buffered
BANK FAN	Hammer Bank Fan
BCOM	Buffered Communication
BCP	Bi-phase Communications Processor
BHSC	Buffered Hammer Shift Clock
BN	Buffered, Low True
BNLD	Buffered, Low True, Lower Driver
BPS	Bits Per Second

BSY . . . . . Busy
BTU . . . . . British Thermal Unit
BUD . . . . . Buffered Upper Driver

CA . . . . . Cathode
CC . . . . . Card Cage
CCF . . . . . Card Cage Fan
CE . . . . . Customer Engineer
CHNG . . . . . Change
CIR . . . . . Circuit
CLK . . . . . Clock
CO . . . . . Cover Open
COLL . . . . . Collector
COMM . . . . . Communication
CONTLR . . . . . Controller
CMD . . . . . Command
CMX . . . . . Manufacturer's designation of the controller board
CNC . . . . . Connector, Connection
CPI . . . . . Characters Per Inch
CR . . . . . Carriage Return
CT . . . . . Coaxial/Twinaxial
CTL . . . . . Control
CTS . . . . . Clear to Send
CUR . . . . . Current
CVO . . . . . Cover Open (Switch)

D0, D1, etc. . . . . Data Bit 0, Data Bit 1, etc.
DAT . . . . . Data
DC . . . . . Direct Current, Data Controller (a functional unit of the CMX controller board)
DCD . . . . . Data Carrier Detect
DIAG . . . . . Diagnostic
DIFF . . . . . Differential
DMA . . . . . Direct Memory Access
DP . . . . . Data Processing, DataProducts
DPMC . . . . . Dot Plucker Memory Controller
DPU . . . . . Data Processing Unit
DRAM . . . . . Dynamic Random-Access Memory
DRV . . . . . Drive or Driver
DRVR . . . . . Driver

DSR . . . . . Data Set Ready
DTR . . . . . Data Terminal Ready

EC . . . . . Engine Controller (a functional unit of the CMX board)
EEPROM . . . . . Electrically Erasable/Programmable Read-Only Memory
EHF . . . . . Exhaust Fan
EL . . . . . Elevator (motor), Power Stacker
EMI . . . . . ElectroMagnetic Interference
EMIT . . . . . Emitter
EPROM . . . . . Electrically Programmable Read-Only Memory
ERR . . . . . Error
ESD . . . . . Electrostatic Discharge
EX . . . . . Exhaust, Extra
EXH . . . . . Exhaust
EXF . . . . . Exhaust Fan
EXP . . . . . Expansion
EXPND . . . . . Expand

FD . . . . . Feed
FF . . . . . Form Feed
FIFO . . . . . First In, First Out
FLT . . . . . Fault
FLTR . . . . . Filter
FP . . . . . Front Panel (Operator Panel)
FTIC . . . . . Fire Timer Integrated Circuit

GND . . . . . Ground

HB . . . . . Hammer Bank
HBA . . . . . Hammer Bank ASIC
HBF . . . . . Hammer Bank Fan
HBL . . . . . Hammer Bank, Left
HBP . . . . . Hammer Bank Power
HBR . . . . . Hammer Bank, Right
HD . . . . . Hammer Driver
HDIC . . . . . Hammer Driver Integrated Circuit
HDPH . . . . . Hammer Driver Phase
HLP . . . . . Hammer Bank Logic, Signals and Power

IC . . . . . Integrated Circuit
ID . . . . . Identification
IGP . . . . . Intelligent Graphics Processor
IML . . . . . Initial Microcode Load
INST . . . . . Instruction
INT . . . . . Interrupt
I/O . . . . . Input/Output
IRQ . . . . . Interrupt Request

(J) . . . . . Jack connector

L . . . . . Left
LCD . . . . . Liquid Crystal Display
LED . . . . . Light Emitting Diode
LF . . . . . Line Feed
LO . . . . . Low
LPI . . . . . Lines Per Inch
LPM . . . . . Lines Per Minute
LRIB . . . . . Left Ribbon
LRP . . . . . Left Ribbon Guide

M1 . . . . . Rear Paddle Motor, Power Stacker
M2 . . . . . Front Paddle Motor, Power Stacker
M . . . . . Motor
MAIN . . . . . Maintenance Jack, RS–232 (Optional)
MECA . . . . . Mechanism Engine Control ASIC
MECH . . . . . Mechanism
MF . . . . . microfarad (10^{-6} farad)
MH . . . . . Mounting Hole
MOSFET . . . . . Metal Oxide Semiconductor Field Effect Transistor
MOT . . . . . Motor
MPU . . . . . Magnetic Pickup (Unit)
ms . . . . . millisecond (10^{-3} second)
MSL . . . . . Motor and Sensors, Left
MSR . . . . . Motor and Sensors, Right

N . . . . . Negative True
N/C . . . . . Not Connected
NC . . . . . Not Connected
NLQ . . . . . Near Letter Quality

No. . . . . Number
NOVRAM . . . . . Non-volatile Random-Access Memory
ns . . . . . nanosecond (10^{-9} second)
NVRAM . . . . . Non-volatile Random-Access Memory
NT . . . . . Not

OLV . . . . . On Line Verify
OP . . . . . Operand

P5 . . . . . + 5 V dc
(P) . . . . . Pin connector
P(1), P(2), etc. . . . . Parallel data 1, data 2, etc.
PAL . . . . . Programmable Array Logic
PAP . . . . . Paper
PAPR . . . . . Paper
PARM . . . . . Parameter
PCBA . . . . . Printed Circuit Board Assembly
PCB . . . . . Printed Circuit Board
PE . . . . . Printer Error, Paper Empty
PER . . . . . Peripheral Device
PF . . . . . picofarad (10^{-12} farad)
PFC . . . . . Paper Feed Controller
PFM . . . . . Paper Feed Motor
PHA . . . . . Phase A
PHB . . . . . Phase B
PI . . . . . Paper Instruction
PLAT . . . . . Platen
PLM . . . . . Platen Motor
PLO . . . . . Platen Open (Switch)
PMD . . . . . Paper Motion Detect (Switch)
PN . . . . . Pin
P/N . . . . . Part Number
PO . . . . . Paper Out
POD . . . . . Paper Out Detect (Switch)
PPR . . . . . Paper
PROM . . . . . Programmable Read-Only Memory
PS . . . . . Power Supply
PS5 . . . . . Power Supply + 5 Volt
PTR . . . . . Pointer or Printer
PWM . . . . . Pulse Width Modulation

PWR . . . . . Power

R . . . . . Right
RBN . . . . . Ribbon
RD . . . . . Read
RET . . . . . Return
RIB . . . . . Ribbon
RG . . . . . Ribbon Guide
RGL . . . . . Ribbon Guide, Left
RGR . . . . . Ribbon Guide, Right
RM . . . . . Ribbon Motor
RML . . . . . Ribbon Motor, Left
RMR . . . . . Ribbon Motor, Right
RQ . . . . . Request
RRIB . . . . . Right Ribbon
RRP . . . . . Right Ribbon Guide
RSP . . . . . Ribbon and Shuttle Processor
RST . . . . . Reset
RTPU . . . . . Real-Time Processing Unit
RTS . . . . . Request to Send
RXD . . . . . Receive Data

SCS . . . . . SNA Character Stream
SEC . . . . . Security (Key)
SEL . . . . . Select
SEN . . . . . Sense, Sensor
SF . . . . . Structured Field
SG . . . . . Signal Ground
SHH . . . . . Shuttle Hall (Effect)
SHM . . . . . Shuttle Motor
SHUT . . . . . Shuttle
SHUTL . . . . . Shuttle
SIMM . . . . . Single Inline Memory Module
SLCT . . . . . Select (On-line)
Slew . . . . . Rapid vertical paper movement
SMD . . . . . Shuttle Motor Drive
SNA . . . . . Systems Network Architecture
SPU . . . . . Shuttle Processor Unit
SRAM . . . . . Static Random-Access Memory
STAT . . . . . Status

STBY . . . . . Standby
STK . . . . . Power Stacker
SW . . . . . Switch
SYNC . . . . . Synchronize

TCB . . . . . Task Control Block
TEMP . . . . . Temperature
TOF . . . . . Top of Form (first print line)
TP . . . . . Test Point
TTL . . . . . Transistor-Transistor Logic
TXD . . . . . Transmit Data

UART . . . . . Universal Asynchronous Receiver/Transmitter
UDPH . . . . . Upper Drive Phase
UNDEF . . . . . Undefined
USART . . . . . Universal Synchronous/Asynchronous Receiver/Transmitter

V . . . . . Volts
V_{CC} . . . . . Voltage at Collector
V_{DD} . . . . . Voltage at Drain
V_{SS} . . . . . Voltage at Source
VX . . . . . A special ASIC containing circuits that help the DC controller operate. The letters VX do not stand for anything; they simply designate this ASIC.

WR . . . . . Write
w/ . . . . . With
w/o . . . . . Without

XMT . . . . . Transmit

G Cords and Adapters

Part Number	Units	Description
1332167	1	Line Cord, IBM, Japan
1838573	1	Line Cord, IBM, 12 Feet, United States, 220 Volt
1838574	1	Line Cord, 220V 6 Feet Non-Lock, United States, Canada
6952299	1	Power Cord, 110V 12 Feet Non-Lock, United States, Canada, Brazil, Cayman Islands, Costa Rica, Dominican Republic, El Salvador, Guatemala, Mexico, Liberia, Panama, Saudi Arabia, Phillipines, Honduras, Peru, Columbia, Nicaragua, Bermuda, Bahamas, Barbados, Bolivia, Guyana, Ecuador, Haiti, Jamaica, Venezuela, Netherlands, Antilles, Trinidad, Suriname, Taiwan, Tobago, Saint Lucia, Indonesia
8509386	1	Cable, PC RS-232, IBM
08H7968	1	Coax Adapter Cable for use with Multi-Platform Interface
13F9941	1	Line Cord, IBM, Australia
13F9980	1	Line Cord, IBM, Europe (EMEA)
13F9998	1	Line Cord, IBM, Denmark
14F0016	1	Line Cord, IBM, Pakistan, South Africa
14F0034	1	Line Cord, IBM, India, United Kingdom
14F0052	1	Line Cord, IBM, Switzerland
14F0070	1	Line Cord, IBM, Chile, Italy
14F0088	1	Line Cord, 9 Feet, Israel
14H5301	1	Line Cord, 6400, 12 Foot, United States, 125 Volt
14H5303	1	Line Cord, 6400, 8 Foot, Chicago
14H5305	1	Line Cord, 6400, 12 Foot, United States, 220 Volt
14H5309	1	Line Cord, 6400, Denmark

Part Number	Units	Description
14H5311	1	Line Cord, 6400, Israel
14H5313	1	Line Cord, 6400, Chile, Italy
14H5315	1	Line Cord, 6400, Switzerland
14H5317	1	Line Cord, 6400, India, United Kingdom
14H5319	1	Line Cord, 6400, Europe (EMEA)
14H5321	1	Line Cord, 6400, Pakistan, South Africa
14H5323	1	Line Cord, 6400, Australia
14H5325	1	Line Cord, 6400, Japan
14H5335	1	Twinax Auto-Termination Cable (47 Inches)
14H5541	1	DP Adapter, 6400
21F4342	1	Cable, AS 400, RS-232, IBM
38F8254	1	Twinax Auto-Termination Cable
57G7261	1	Power Cord, 6 Feet, Non-Lock, United States, Canada,110 Volt
58F2861	1	Conn, Cable, RISC 6000, IBM
63H7362	1	Cable, RISC 6000
63H7364	1	Cable, AS 400, RS-232
63H7366	1	Cable, PC Parallel
63H7368	1	Cable, PC RS-232
63H7456	1	LAN Power Coupling
92F3176	1	Cable, PC Parallel, IBM

H Part Numbers

Part Number	Page	Description
04H4779	263	Riser, Stacker Runner
08H7934	285	Platen Open Motor Pulley
08H7936	283	Platen Assembly
08H7954	269	Anti-Static Brush Kit
14H5154	285	Platen Open Motor Assembly
14H5159	285,328	Hammer Bank Fan Assembly
14H5169	283	Platen Hardware Kit
14H5174	269	Platen/Paper Feed Cover Kit
14H5179	269	Paper Scale
14H5211	275	Clamp, Shaft, Receiving
14H5214	281	Tractor Shaft Kit
14H5217	281	Tractor Shaft Hardware Kit
14H5235	269	Shroud Assembly, Air (Shuttle Cover)
14H5271	269	Paper Guide Assembly (Models 004, 005, 008, 009, 012, 014)
14H5272	263	Chain Assembly Kit
14H5274	275	Shuttle Frame Assy (Models 004, 04P)
14H5275	275	Hammer Spring Kit (Models 004, 04P, 005, 05P)
14H5279	314	Cable Assy, Hammer Bank Logic

Part Number	Page	Description
14H5280	283,332	Platen Switch Kit
14H5281	285,331	Paper Detector Switch Assembly (Standard)
14H5282	275,330	Switch Assembly, Cover Open
14H5283	315	Cable Assy, Hammer Bank Power
14H5285	311	Cable Assy, Card Cage Fan
14H5286	313	Cable Assy, Exhaust Fan
14H5287	275, 291, 316	Centronics I/O Cable Assembly
14H5288	199	Housing, Connector Kit
14H5289	309	Cable Assy, AC In, Power Supply (Part of AC Field Kit)
14H5289	310	Cable Assy, AC Power Input (Part of AC Field Kit)
14H5296	263	Spares Kit, Grommet
14H5299	265	Operator Panel Assembly (Cabinet)
14H5300	265, 267	Cable Assembly, Operator Panel
14H5329	279,317	Cable Assembly, MPU
14H5330	320	Cable Assembly, Shuttle Motor Drive
14H5481	226	SIMM, DRAM, Blank, 2MB
14H5490	226	Security Module, Graphics
14H5499	226	SIMM, DRAM, Blank, 1MB
14H5508	226	SIMM, DRAM, Blank, 4MB
14H5509	226	Security Module, Base
14H5512	275	Hammer Spring Kit (Models 008, 08P, 009, 09P)
14H5513	275	Hammer Spring Kit (Models 012, 014)
14H5516	275	Shuttle Frame Assy (Models 008, 08P)
14H5517	275	Shuttle Frame Assy (Model 012)

Part Number	Page	Description
14H5520	285	Paper Feed Motor
14H5521	285	Motor Assembly, Ribbon
14H5522	275, 322	Cable Assy, Centronics/Dataproducts Adapter
14H5525	243	Resistor Kit
14H5589	323	Cable Assy, +5V Remote Power
14H5539	226	SIMM, Flash, Blank, 1MB
14H5540	226	SIMM, Flash, Blank, 2MB
14H5567	261	Wireform Paper Path
14H5571	287	Circuit Breaker
14H5572	261	Hardware Kit
14H5585	289	CT Plate
14H5592	205	Cable, Data, Coax/Twinax Multi-Platform Interface
14H5593	205	I/O Bracket Assembly, Coax/Twinax Multi-Platform Interface
14H5595	205	PROM, Coax/Twinax Multi-Platform Interface
14H5603	261	Logo, 6400
14H5643	275	CMX Controller Board, V5.0 (All models 004 and 04P. Models 008 and 012 with Serial Nos. 01AXXXX, 01BXXXX, and 01CXXXX.)
14H5644	275	Power Supply PCBA, (Models 004, 04P, 005, 05P, 008, 08P, 012)
24H8533	267	Input Tray (Optional)
24H8535	289	Adapter, Expansion Connector, 60-pin
24H8593	281	Paper Support
24H8647	275	CMX Controller Board, V5.5, 25 MHz (All models 005, 05P, and 08P. Models 008 and 012 with Ser. Nos. 01DXXXX, 01EXXXX, and higher. All models 009 and 09P.)

Part Number	Page	Description
24H8648	275	Shuttle Frame Assy (Models 005, 05P)
24H8766	18	6400 Operator's Guide, English
24H8767	18	6400 Operator's Guide, Spanish
24H8768	18	6400 Line Matrix Printer Setup Guide, French
24H8769	18	6400 Operator's Guide, Italian
24H8770	18	6400 Operator's Guide, German
24H8771	18	6400 Operator's Guide, Dutch
24H8772	18	6400 Operator's Guide, Brazilian Portuguese
24H8773	18	6400 Line Matrix Printer Operator's Guide, Japanese
24H8774	18	6400 Line Matrix Printer Setup Guide, English
24H8775	18	6400 Line Matrix Printer Setup Guide, Spanish
24H8776	18	6400 Operator's Guide, French
24H8777	18	6400 Line Matrix Printer Setup Guide, Italian
24H8778	18	6400 Line Matrix Printer Setup Guide, German
24H8779	18	6400 Line Matrix Printer Setup Guide, Dutch
24H8780	18	6400 Line Matrix Printer Setup Guide, Brazilian Portuguese
24H8781	18	6400 Line Matrix Printer Setup Guide, Japanese
24H8828	277	Ribbon Mask, 500 (Models 050, P50)
24H8844	277	Ribbon Mask, 1000 (Models 010, 10P)
24H8858	277	Ribbon Mask, 1500 (Model 015)
24H8872	277	Hammer Bank Cover Assy, 500 (Models 050, P50)
24H8886	277	Hammer Bank Coverr Assy, 1000 (Models 010, 10P)
24H8888	18	6400 ASCII Programmer's Reference
24H8889	18	6400 IGP User's Manual

Part Number	Page	Description
24H8890	18	6400 Code V User's Manual
24H8891	18	6400 CTA Programmer's Reference
24H8892	18	6400 IPDS Programmer's Reference
24H8893	19	Ethernet Interface User's Manual
24H8894	285,318	Ribbon Guide Kit
24H8924	277	Hammer Bank Coverr Assy, 1500 (Model 015)
24H8925	277	Shuttle Frame Assembly, 500 (Models 050, P50)
24H8927	277	Shuttle Frame Assembly, 1000 (Models 010, 10P)
24H8929	277	Shuttle Frame Assembly, 1500 (Model 015)
24H8931	277	Hammer Spring Field Kit, 500 (Models 050, P50)
24H8932	277	Hammer Spring Field Kit, 1000 (Models 010, 10P)
24H8933	277	Hammer Spring Field Kit, 1500 (Model 015)
24H8959	261	Front Door Kit
24H8960	261	Rear Door Kit
24H8961	261	Top Cover Kit
24H8994	291	Ethernet LAN PCBA, 10-Base-2
24H8995	291	Ethernet LAN PCBA, 10-Base-T
24H9011	289	Expansion-CT PCBA
26H9625	275	Shuttle Frame Assy (Models 009, 09P)
30H3981	263	Runner, Stacker
30H3985	279	Extension Spring
30H3986	261	Shipping Container Kit
30H4008	261	Wire Rope
30H4056	19	Print Server User's Guide
38F8254	321	Twinax Auto-Termination ("Smart T")

Part Number	Page	Description
57G1421	285	Motor Pulley, Paper Feed
57G1440	265	Fan Assembly
57G1453	285	Paper Detector Switch Assy
57G1460	281	Splined Shaft
57G1466	281	Tractor Set
57G1468	269	Belt, Timing, 050P, 100 Teeth (Paper Feed)
57G1467	283	Belt, Timing, 312W, 87 Teeth (Platen Open)
57G1469	283	Ironer Assembly, Reverse Paper Feed
57G1476	279,329	Magnetic Pickup Assembly (MPU)
57G1479	285	Ribbon Hub Kit
57G1481	265	Gas Spring Kit
57G1485	261	Caster, with Brake
57G1486	261	Caster, without Brake
57G1492	261	Window, Top Cover
57G1514	283	Platen Pulley, Driven
57G1521	281	Ground Clip, Splined Shaft
57G1571	281	Bracket, Ironer
57G1598	265	Operator Panel Overlay, English
57G1599	265	Operator Panel Overlay, Spanish
57G1600	265	Operator Panel Overlay, French
57G1601	265	Operator Panel Overlay, Italian
57G1602	265	Operator Panel Overlay, German
57G1603	265	Operator Panel Overlay, Dutch
57G1604	265	Operator Panel Overlay, Braz. Portuguese
57G7176	263	Stacker

Part Number	Page	Description
57G7260	263	Power Cord, U.S. (See also Appendix G.)
63H5116	271	Paper Path Assembly (Models 04P, 05P, 08P, 09P)
63H5118	267	Paper Basket
63H5119	267	Lid, Pedestal Model
63H5120	267	Top Cover, Complete (Pedestal Model)
63H5121	267	Hinge Lid Kit (Pedestal Model)
63H5122	267	Lid Accessory Kit (Pedestal Model)
63H5123	267	Shipping Container, Pedestal
63H5124	267	Operator Panel (Pedestal)
63H5125	267	Bracket, Control Panel
63H5133	285,331	Paper Detector Switch Assy (Black Back)
63H7379	26	6400 Line Matrix Printer Configuration Utility Disk
63H7398	261	Top Cover Seal Kit
63H7464	319	Cable Assembly, Ribbon Motor, Extension
63H7478	283	Platen Lever Kit
63H7509	267	Caster, Pedestal
63H5117	267	Pedestal Kit
63H7510	261	Door Seal Kit
63H7518	275	Hmr Bank/Rbn Mask Cov Assy (Models 004, 04P, 005, 05P)
63H7519	275	Hmr Bank/Rbn Mask Cov Assy (Models 008, 08P, 009, 09P)
63H7520	275	Hmr Bank/Rbn Mask Cov Assy (Models 012, 014)
83F2834	26	Torx T-10 Bit
90H3268	275	Power Supply PCBA (Models 009, 09P, 014)
90H3269	275	Shuttle Frame Assy (Model 014)

Part Number	Page	Description
90H3271	275	CMX Controller Board, V5.5, 40 MHz (Models 050, P50, 010, P10, 014, 015)
S246–0149	18	6400 Coax/Twinax Multi-Platform Interface Option Installation and Operation Guide

Noise Suppression Devices

Ferrite noise suppressors are installed in the printer to reduce radio frequency interference (RFI) to and from electronic equipment located near the printer.

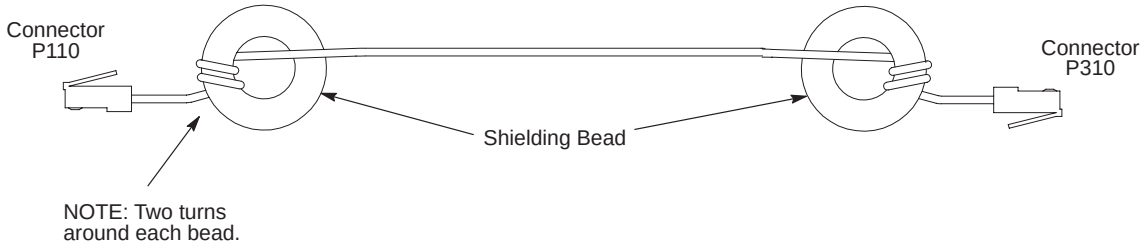
Two kinds of ferrite noise suppressors are used:
1. Shielding Bead—Cylindrical core through and around which the control panel cable assembly is wound. Two are required.
2. Ferrite Clamp—A noise suppression core housed in a hinged plastic case and attached with adhesive to the wall of the card cage. The parallel I/O cable assembly passes through this core.

Figure 56 shows how these devices are installed. If you replace either of these cable assemblies, note the number and location of noise suppressors before remove the defective cable. Make sure you install the noise suppressors on the replacement cable assembly.

IMPORTANT

Duplicate the number of turns around the shielding beads when installing or replacing the control panel cable. See Figure 56.

Control Panel Cable Assembly



Parallel I/O Cable Assembly

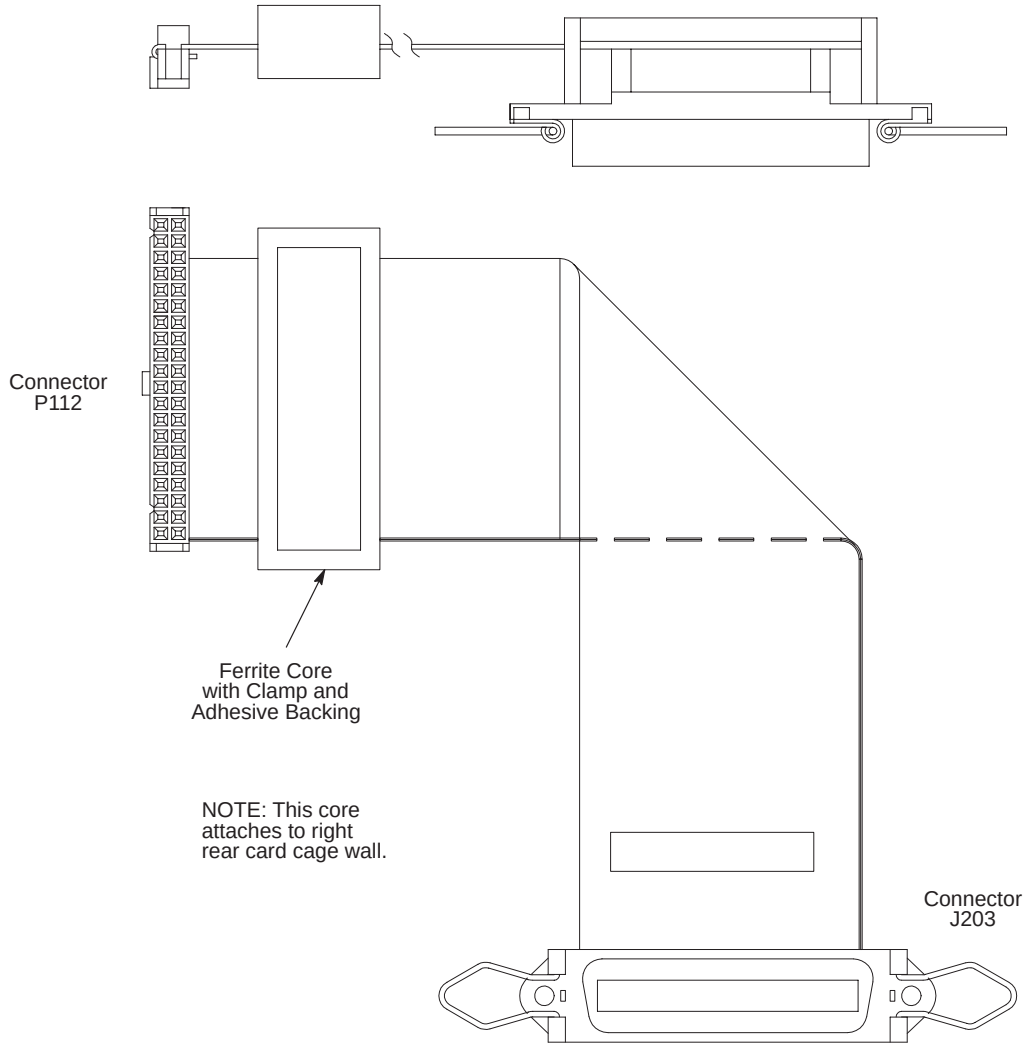


Figure 56. Ferrite Core Installation

J SureStak** Power Stacker

Contents of This Appendix

Introduction 377

Removing the Power Stacker 378

Installing the Power Stacker 383

Replacement Procedures

- Constant Force Spring 393
- Timing Belts 396

Illustrated Parts Breakdown 399

Introduction

The SureStak Power Stacker is a factory-installed option for cabinet model line matrix printers.

Because all but a small portion of the stacker assembly is inside the cabinet, the stacker assembly must be removed from the printer in order to service the unit or replace most of its components.

This appendix consists of two parts:

- Removal/installation instructions for the power stacker assembly and components that require the most frequent replacement.
- An illustrated parts breakdown (IPB) showing how the entire power stacker unit is assembled. The IPB also lists the part numbers for replaceable parts.

NOTE: Only replaceable parts have part numbers in the IPB. If you need to replace a part for which no part number is shown, replace the entire power stacker assembly.

Removing the Power Stacker

1. Prepare the printer for maintenance (page 194).
2. Unload paper from the stacker area. (Refer to the *User's Manual*.)
3. Remove the paper tent. (See Figure 57.)

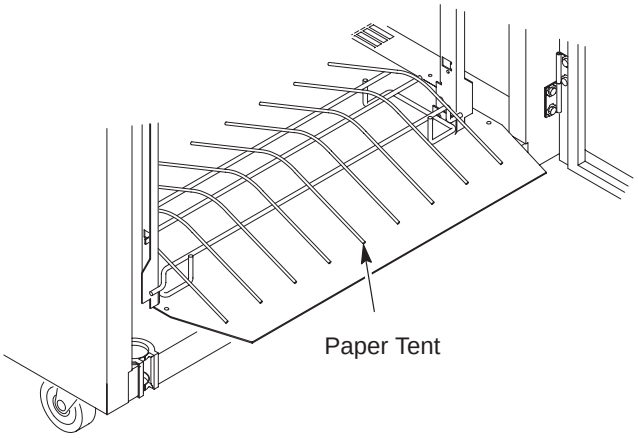


Figure 57. Removing the Paper Tent

4. Remove the paper fence. (See Figure 58.)

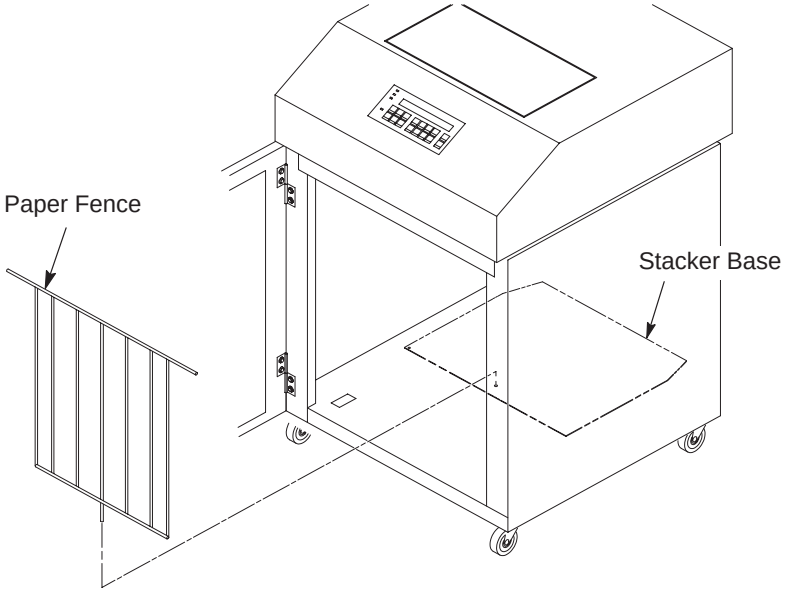


Figure 58. Removing the Paper Fence

5. Remove the paper deflector. (See Figure 59.)

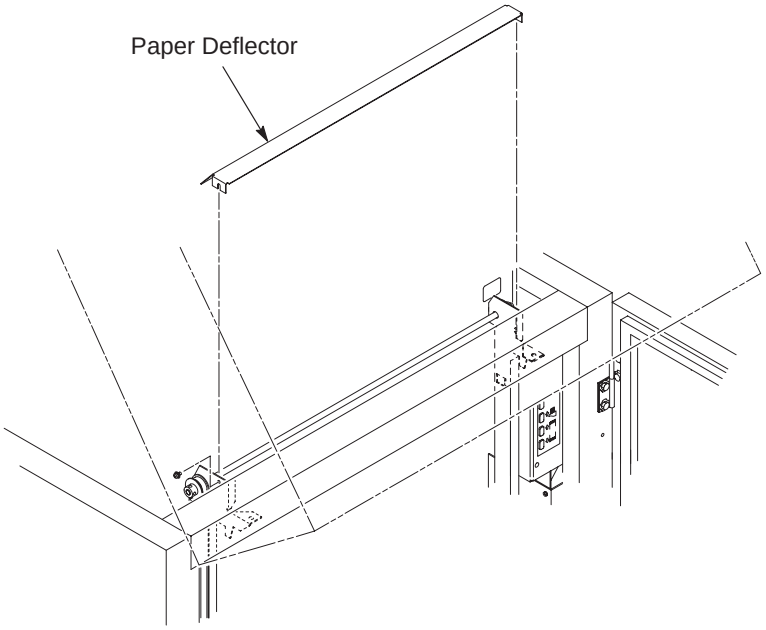


Figure 59. Removing the Paper Deflector

6. Remove three screws and washers from the stacker control panel. (See Figure 60.)

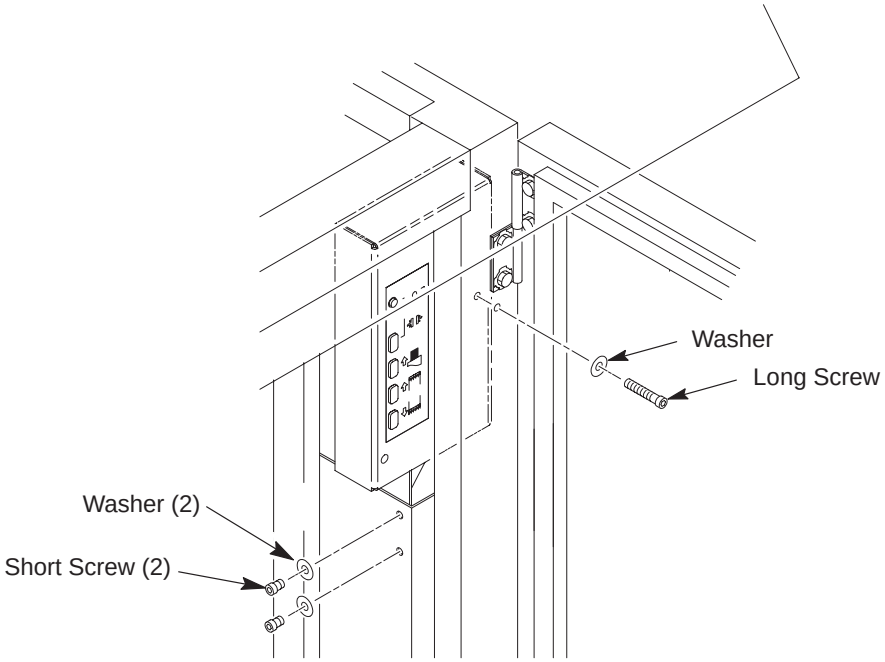


Figure 60. Removing the Stacker Control Panel

7. Close the top cover, remove four cables from the stacker control panel, and remove the stacker control panel. (See Figure 61.)

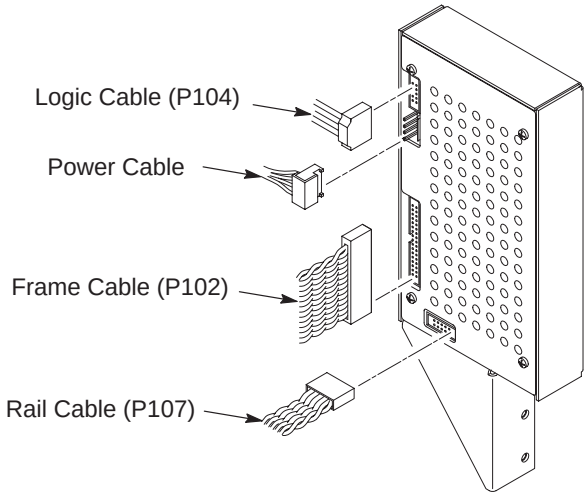


Figure 61. Removing Cables from the Stacker Control Panel

8. Remove the two 5/32 x 3/4 inch screws and washers securing the vertical rails to the upper frame cross-member at the rear of the cabinet. (See Figure 62.)

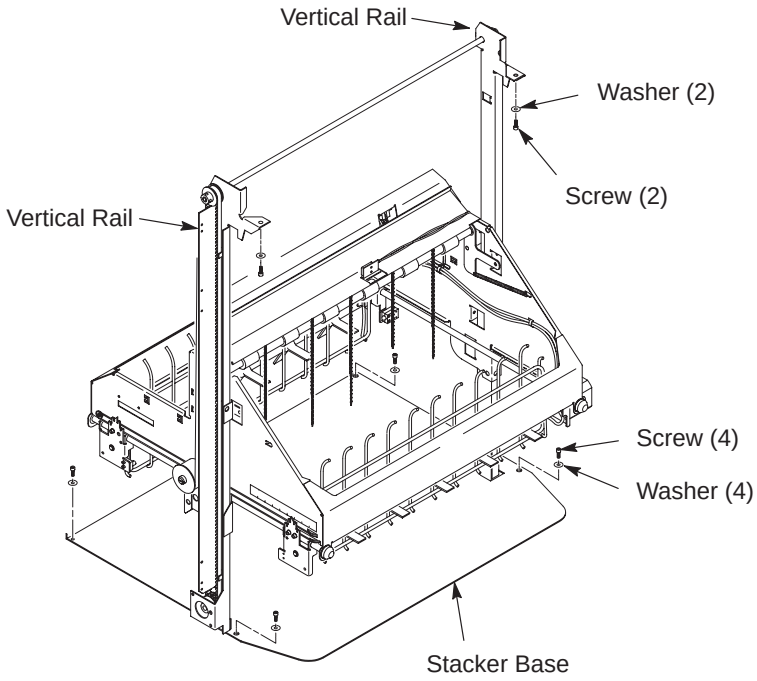


Figure 62. Preparing the Stacker for Removal

9. Raise the elevator assembly.

10. Loosen the screws securing the vertical rails to the stacker base one turn—do not remove the screws. Each rail is secured by two screws. (See Figure 63.)

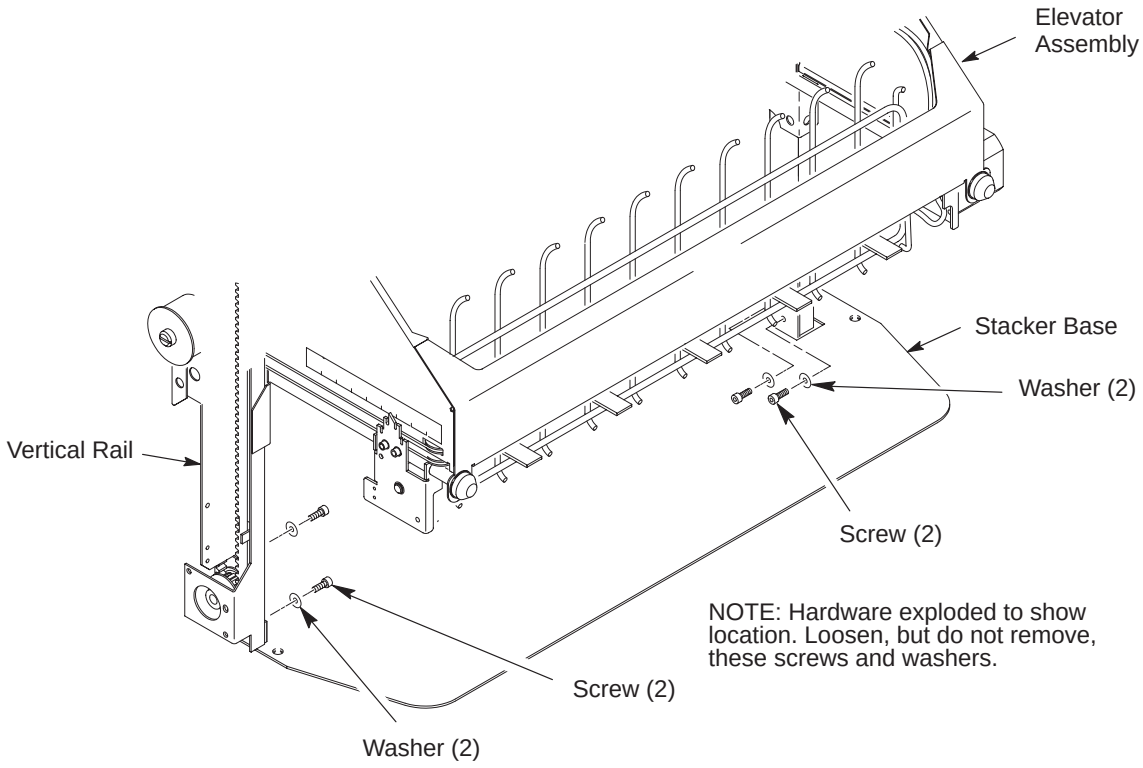


Figure 63. Loosening the Lower Screws in the Vertical Rails

11. Remove the four 7/64 x 1/2 inch screws and washers securing the base plate to the cabinet floor. (See Figure 62.)

12. Lower the elevator assembly to its lowest position.

13. Tilt the vertical rails toward the front of the printer until they clear the upper frame cross-member. Slide the stacker assembly to rear and angle it out of the cabinet, as shown in Figure 64.

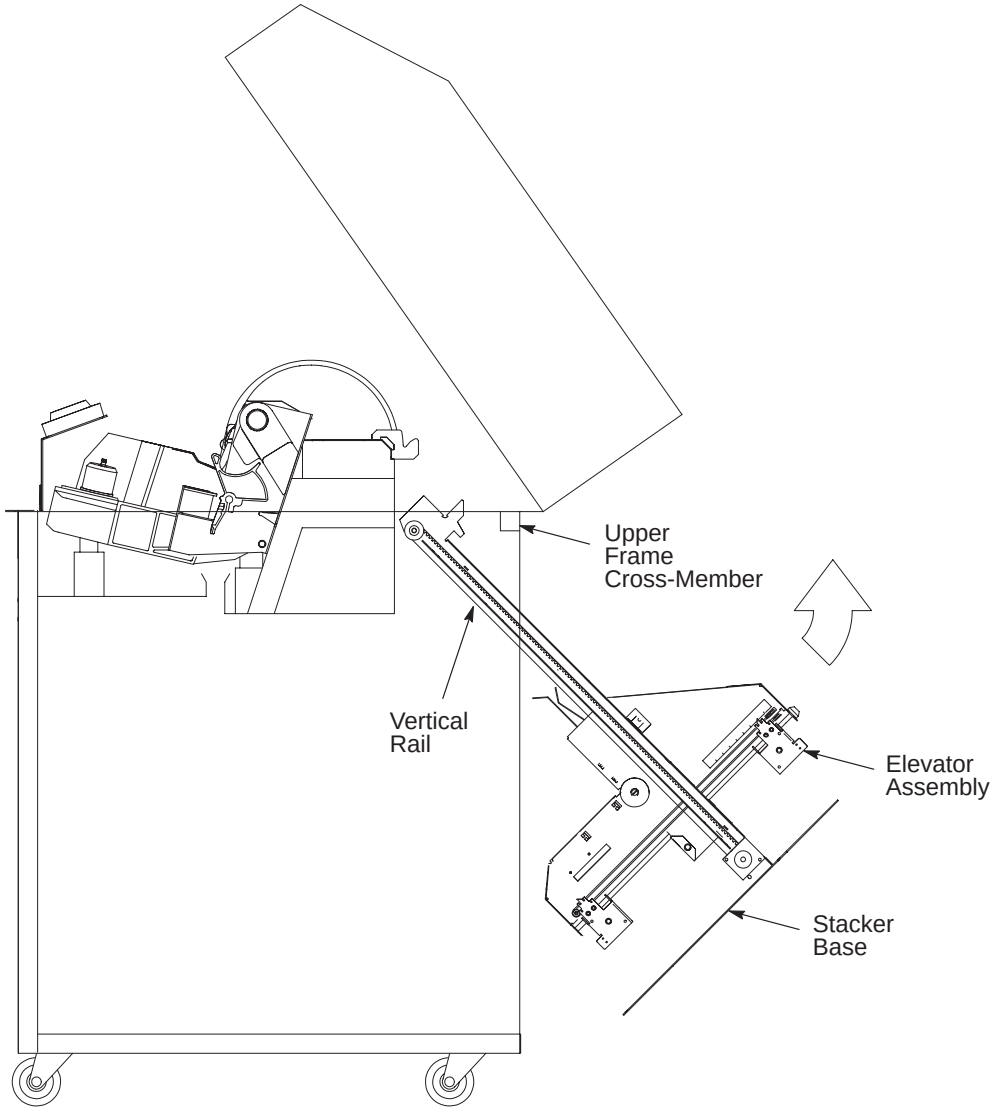


Figure 64. Removing the Stacker Assembly

Installing the Power Stacker

1. Prepare the printer for maintenance (page 194).
2. Remove paper.
3. Loosen the three paper path hold-down screws. Slide the paper path to the left and lift it off the card cage. (See Figure 65.)

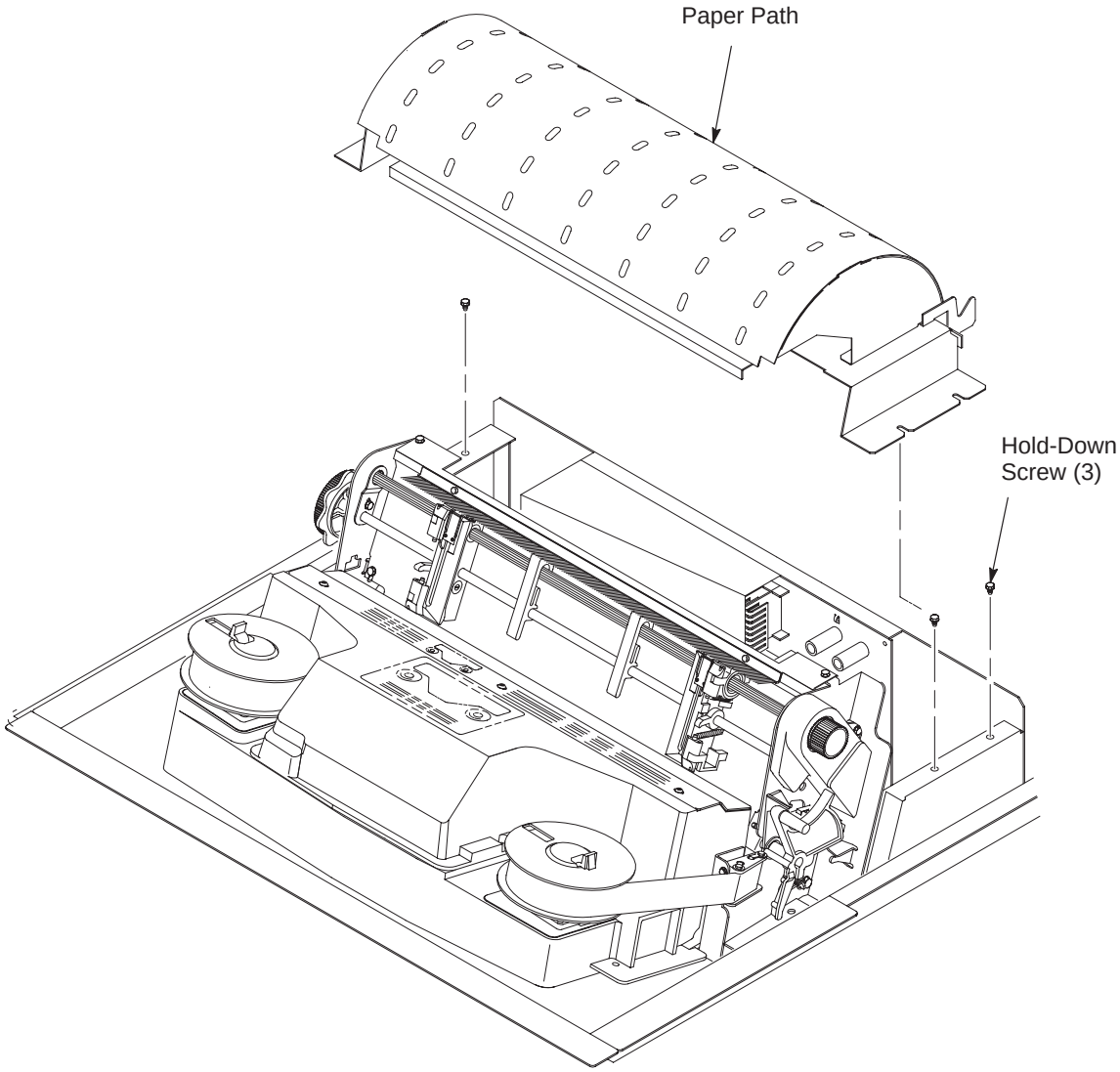


Figure 65. Remove the Paper Guide

4. Connect the power stacker logic cable P103 to connector J17 on the CMX controller board. (See Figure 66.)

5. Disconnect the power supply cable from connector J101 on the CMX controller board. (See Figure 66.)

6. Connect power supply cable connector P101 to the stacker power cable, then connect the stacker power cable to connector J101 on the CMX controller board. (See Figure 66.)

7. Route the stacker power cable and the stacker logic cable in front of the CMX board and through the cutout beneath the card cage fan, as shown in Figure 66.

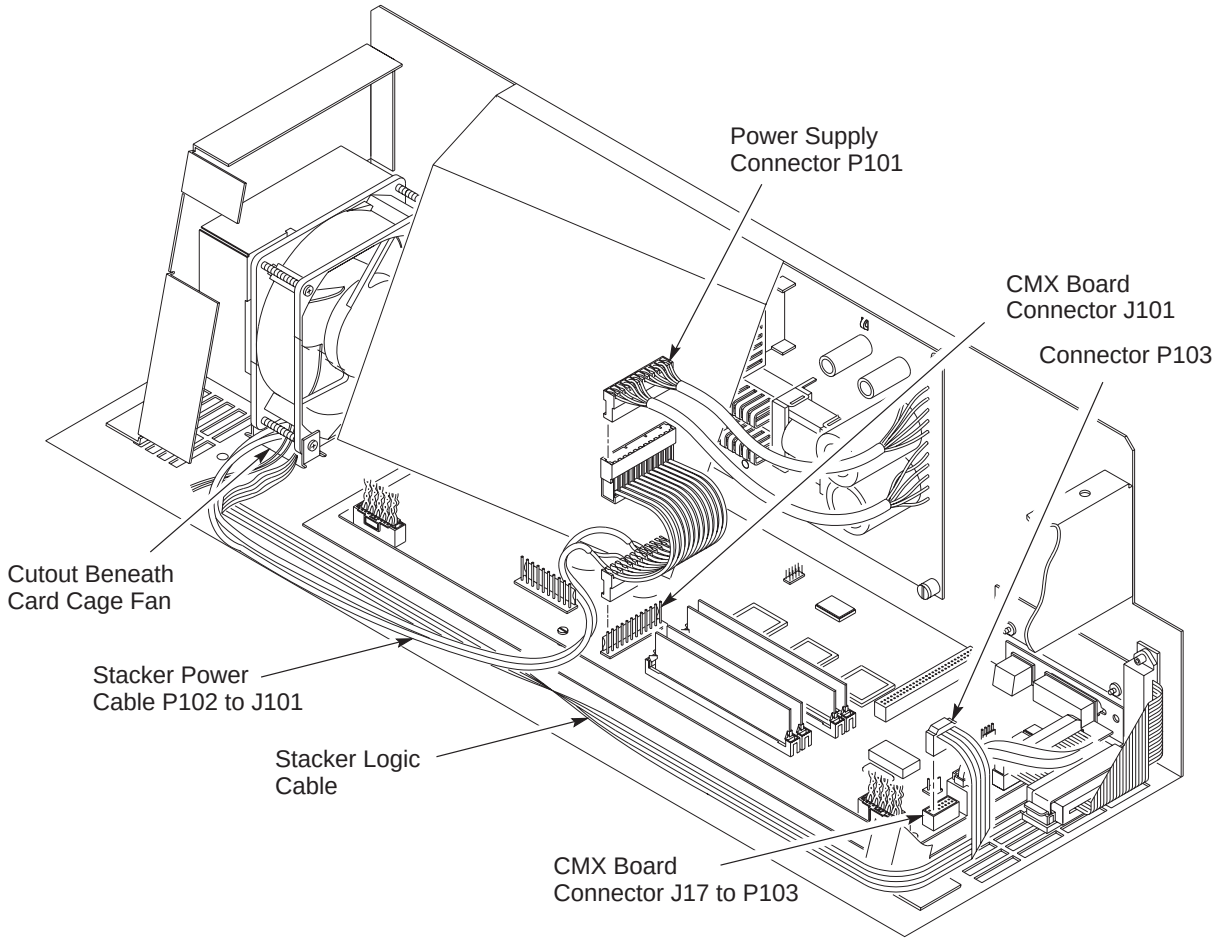


Figure 66. Stacker Power and Logic Connections on the CMX Controller Board

8. Loosen the screws at the bottom of each vertical rail one turn—do not remove the screws. Each rail is secured by two screws. (See Figure 67.)

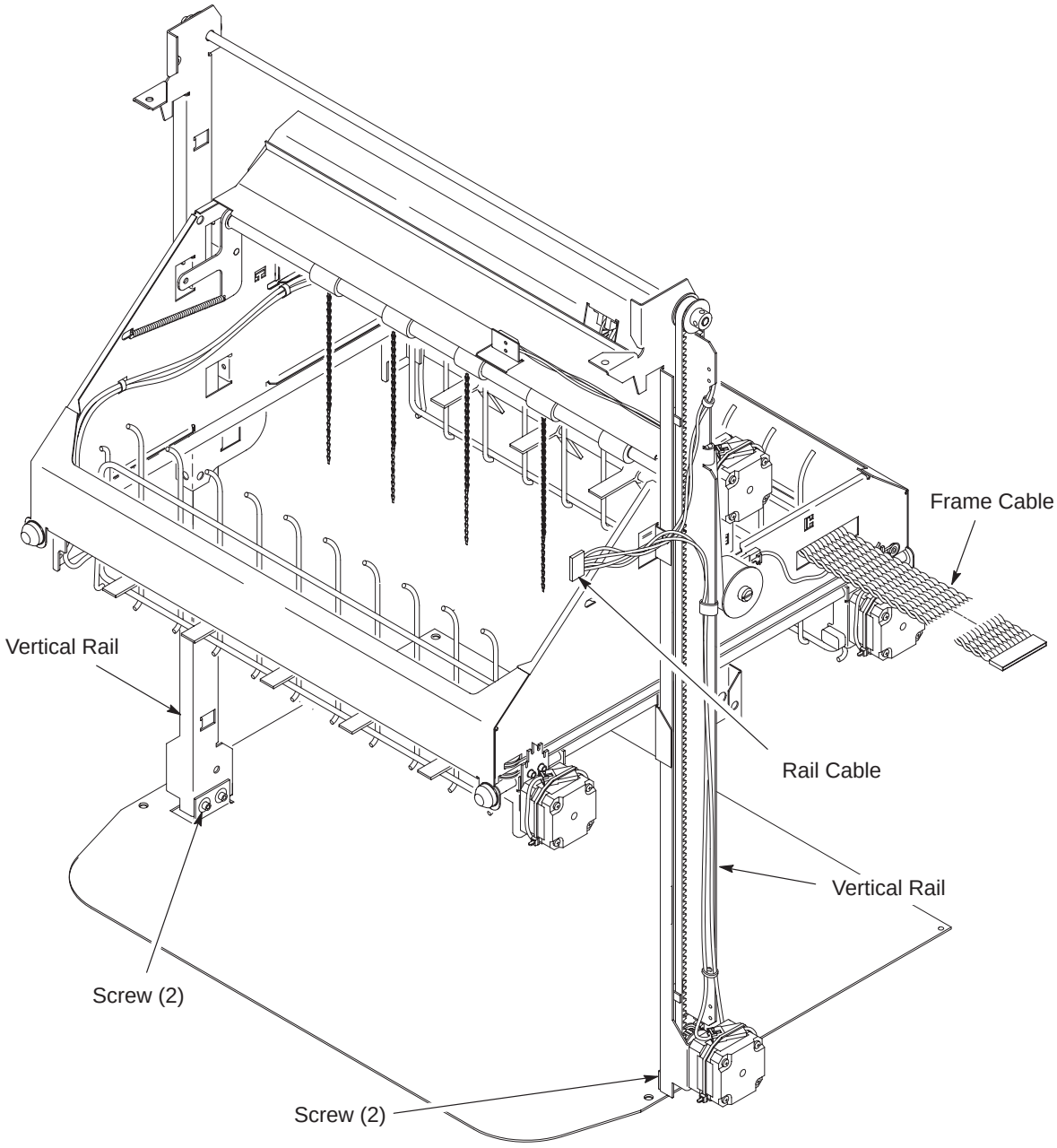


Figure 67. Stacker Rail and Frame Cables

ATTENTION

The paper stacker assembly mounts to the rear upper frame cross-member and to the cabinet floor. It is a snug fit. During installation, take care to avoid scratching painted surfaces or damaging the stacker.

9. Position the elevator assembly at the bottom of the vertical rails. (See Figure 68a.)

10. Insert the vertical rails inside and under the upper frame cross-member, then slowly swing the base of the stacker assembly into the cabinet. (See Figure 68a.)

11. Work the stacker base rearward and engage the upper brackets of the vertical rails under the upper frame cross-member. (See Figure 68b.)

12. Align the holes in the vertical rail brackets with the holes in the upper frame cross-member.

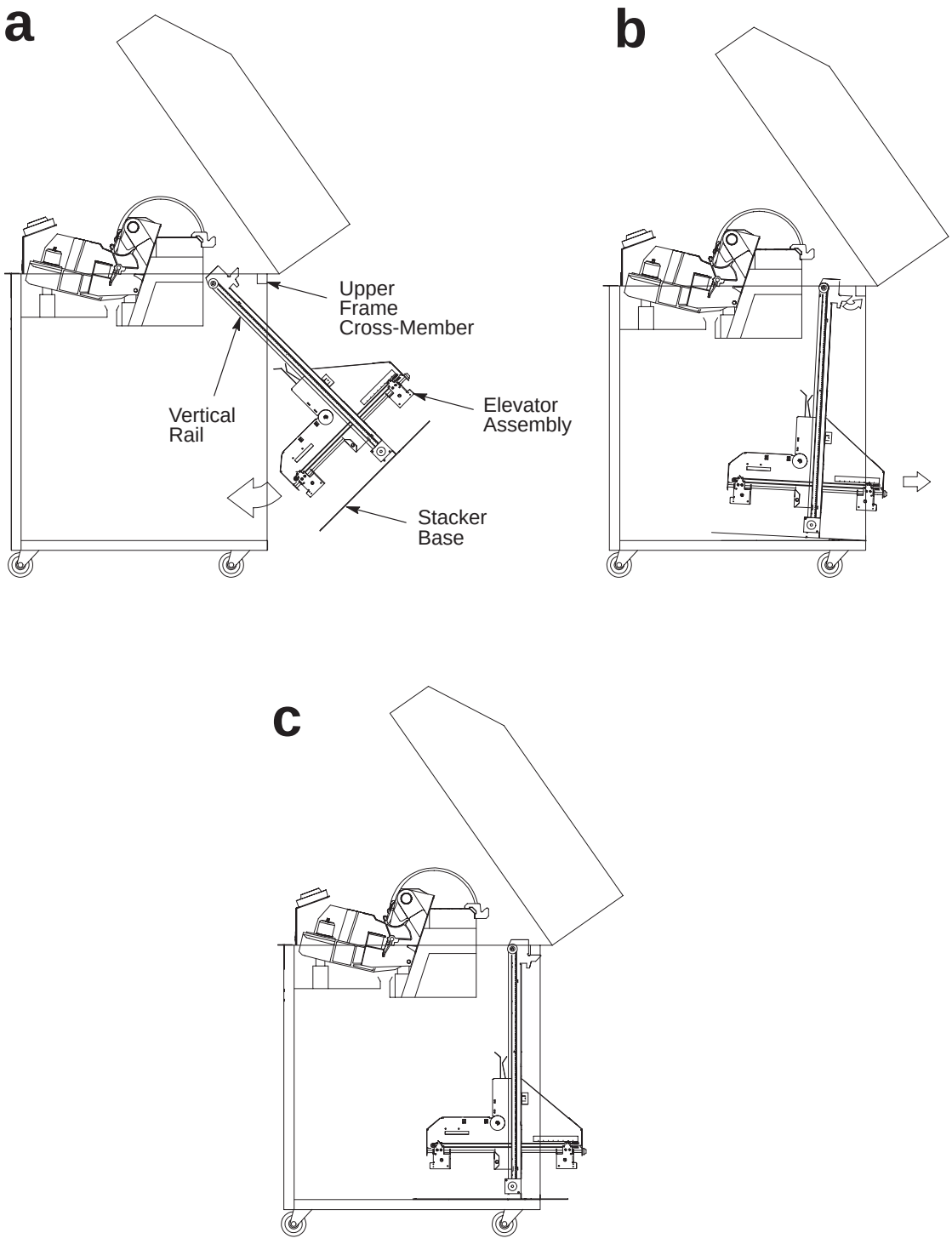


Figure 68. Stacker Installation

13. Align the holes in the stacker base with the holes in the cabinet floor. (See Figure 68c and Figure 69.)

14. Install two 5/32 x 3/4 inch screws and washers to secure the vertical rails to the upper frame cross-member.

15. Install four 7/64 x 1/2 inch screws and washers to secure the stacker base to the cabinet floor. (See Figure 69.)

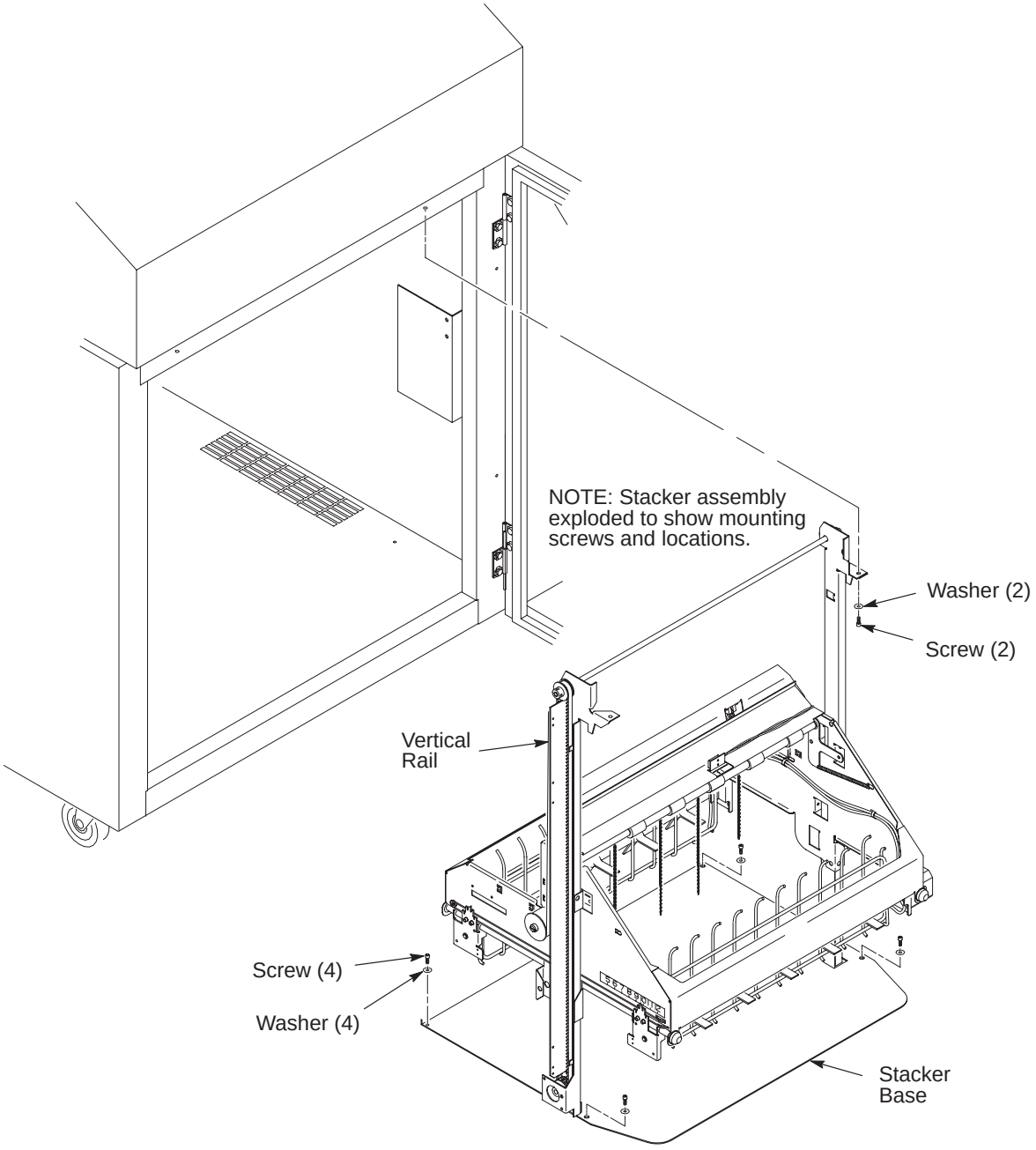


Figure 69. Stacker Fasteners

16. Tighten the four screws you loosened in step 8. When correctly installed, the stacker vertical rails are parallel and vertical, as shown in Figure 68c.

17. Install the paper fence. (See Figure 70.)

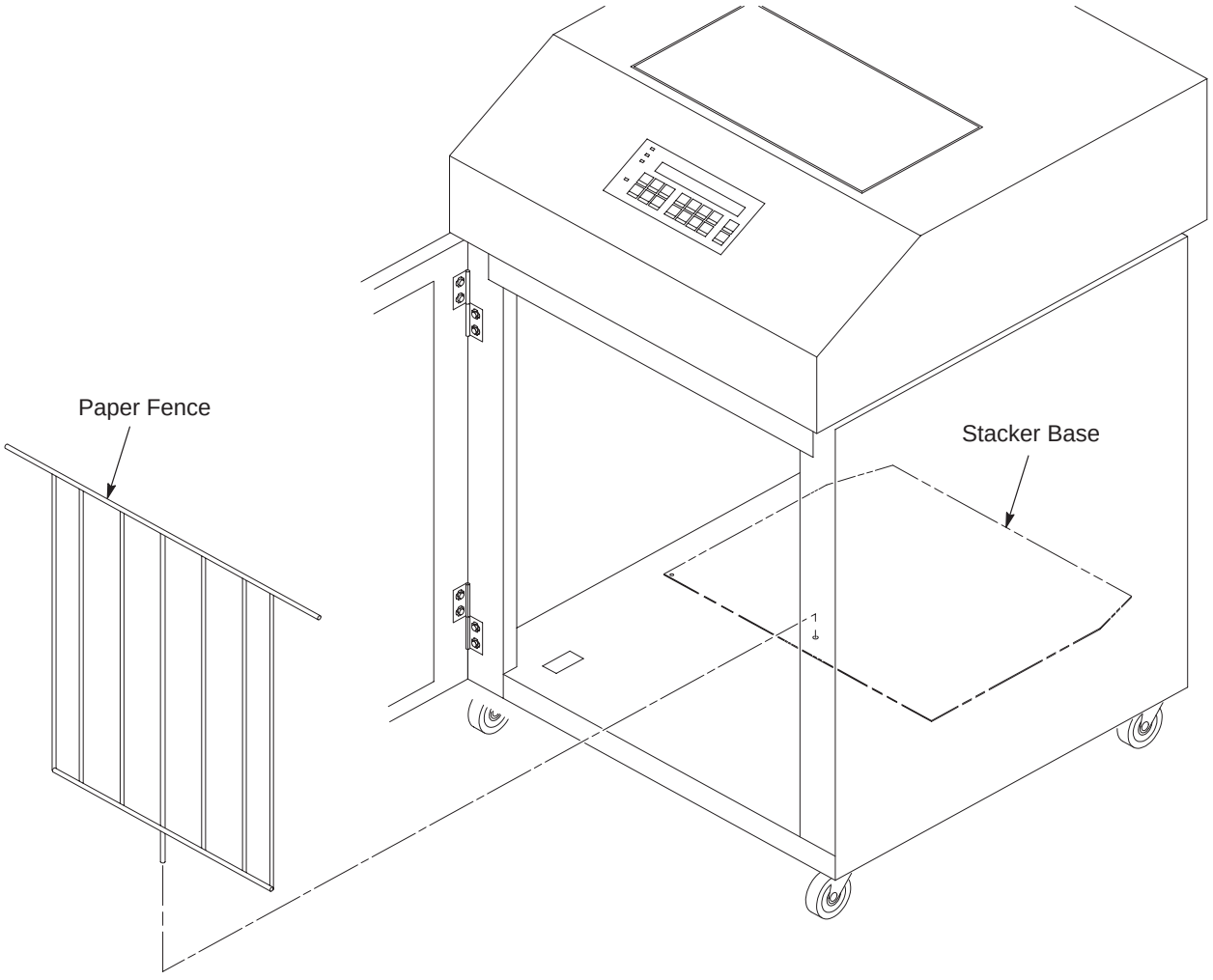


Figure 70. Paper Fence

18. Gather the rail cable, frame cable, logic cable, and power cable. Make sure these cables are routed outboard of the elevator assembly.

19. Connect the stacker cables to the rear of the stacker control panel assembly, as shown in Figure 71.

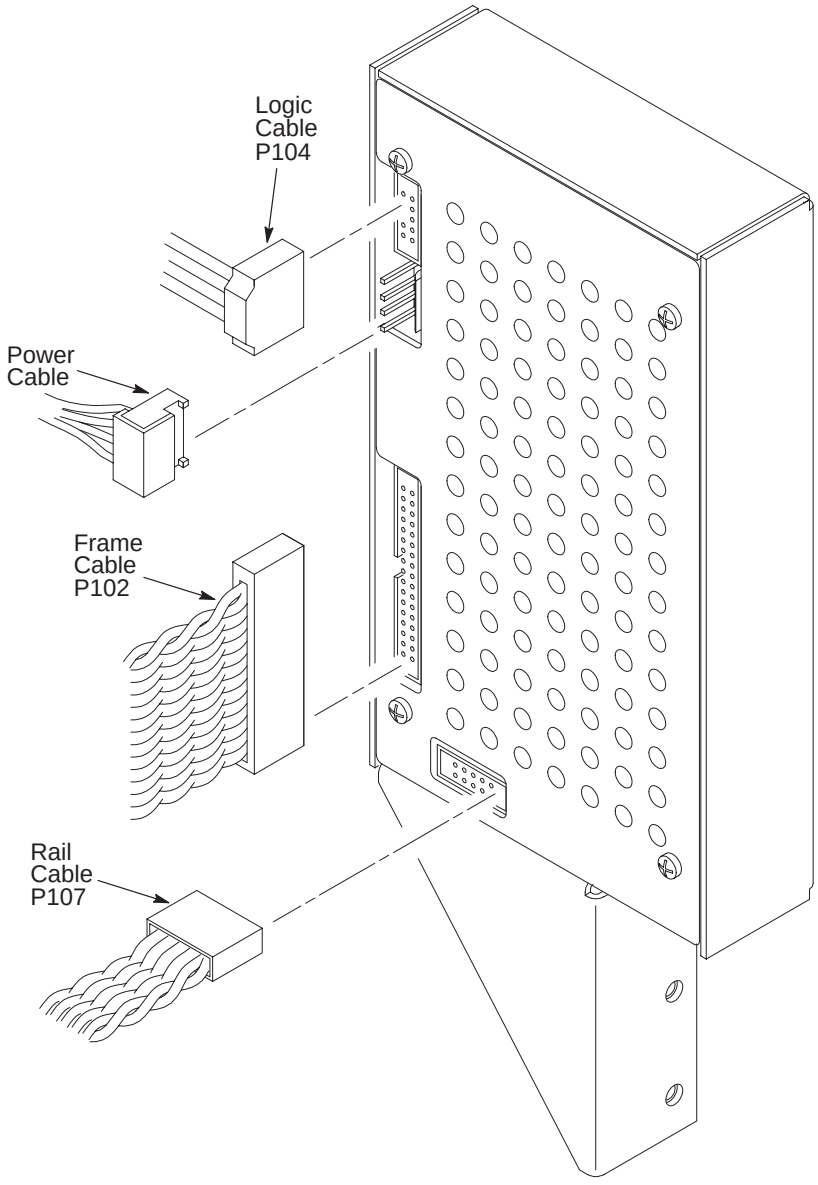


Figure 71. Stacker Control Panel Cables

20. Close the top cover, position the stacker control panel as shown in Figure 72, and install the mounting screws.

21. Bundle and tie wrap the stacker control panel cables to the printer frame so they do not catch in the stacker mechanism as it moves up and down. Route the stacker rail and frame cables so they move without snagging as the elevator assembly moves up and down.

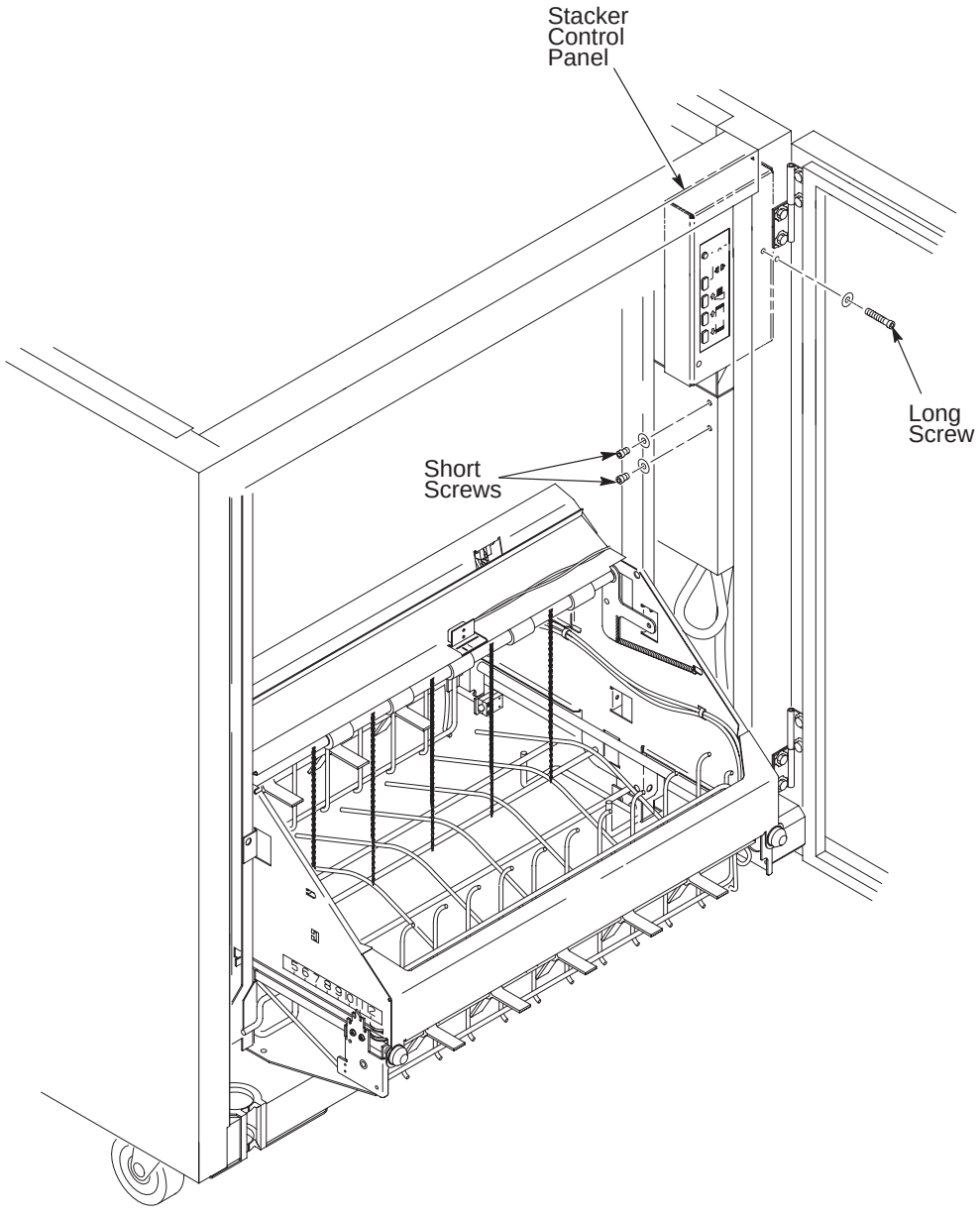


Figure 72. Installing the Stacker Control Panel

22. Install the paper deflector on the vertical rails with the angled portion toward the front of the printer, as shown in Figure 73.

23. Install the paper path that you removed in step 3 (page 383).

24. Install paper and test stacker operation. (Refer to the *User's Manual*.)

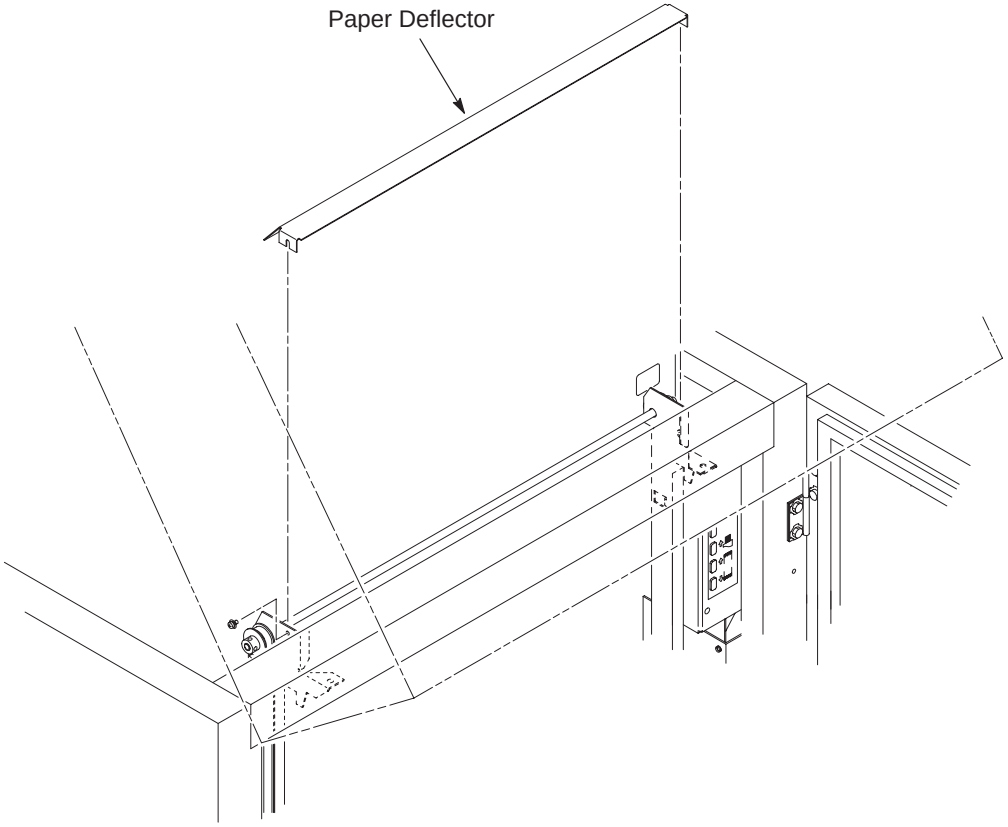


Figure 73. Installing the Paper Deflector

Replacing the Constant Force Spring

1. Remove the stacker assembly from the printer. (See page 378.)

ATTENTION

In the next step, do not over-tighten the tie wraps or string. Tighten the tie wraps or string just enough to hold the elevator up.

2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. (See Figure 74.)

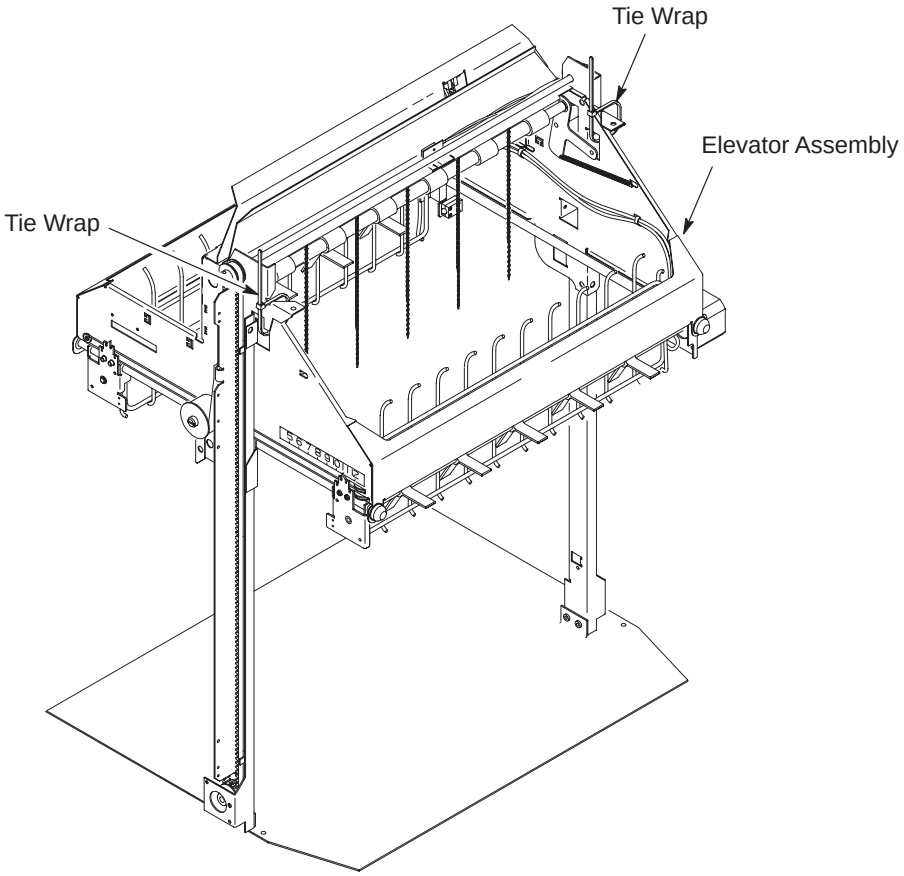


Figure 74. Securing the Elevator Assembly

CAUTION:

The constant force spring is a high tension spring. To avoid pinching your fingers, coil the spring slowly and carefully. Do not let the spring twist or crimp.

3. Remove the shoulder screw, washers, and spacer from the constant force spring and drum. Let the spring coil itself up until it reaches the screw that secures it to the vertical rail. (See Figure 75.)

4. Firmly gripping the spring and drum, remove the screw securing the spring to the vertical rail. (See Figure 75.)

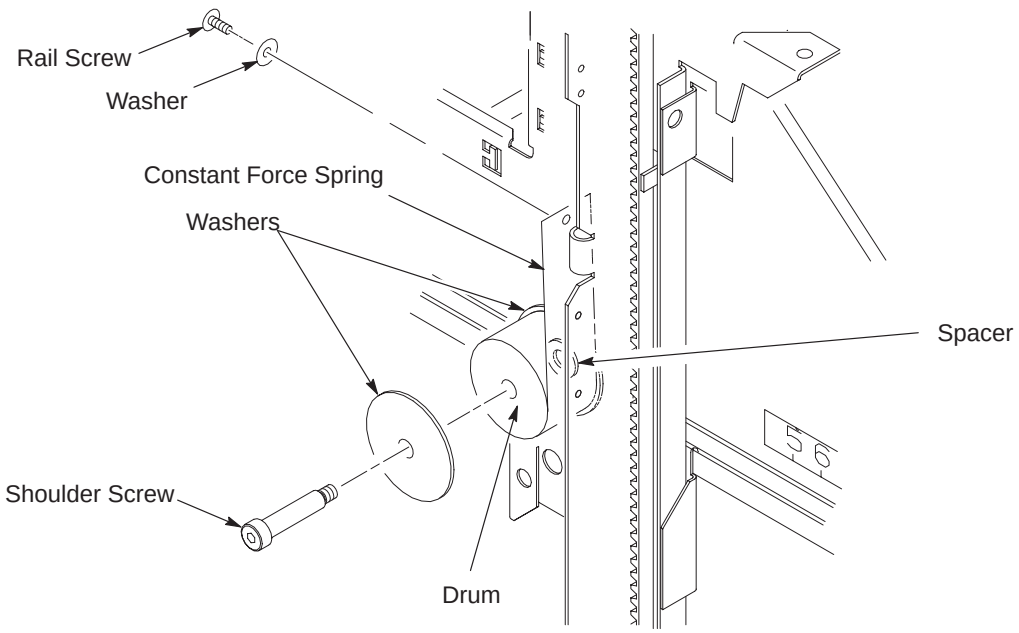


Figure 75. Removing the Constant Force Spring

5. Lift the loose end of the constant force spring and let it curl up on the outside of the remaining spring and drum. (See Figure 76.)

6. While holding the drum tightly, continue to curl the spring until it is completely unwound from the drum. (See Figure 76.)

7. To install a new constant force spring, reverse the steps of this procedure.

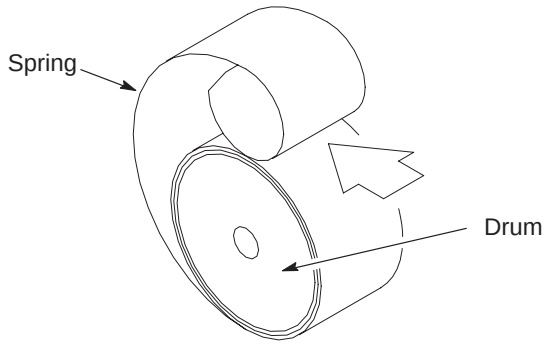


Figure 76. Removing the Constant Force Spring from the Drum

Replacing the Timing Belts

1. Remove the stacker assembly from the printer. (See page 378.)
2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. (See Figure 74.)
3. If you are removing the left timing belt, remove the shoulder screw from the pulley at the bottom of the left vertical rail, and remove the pulley. (See Figure 77.) Go to step 6.
4. If you are removing the right timing belt, remove the two metric Allen screws that secure the timing belt motor to the right vertical rail. (See Figure 77.) Go to step 5.

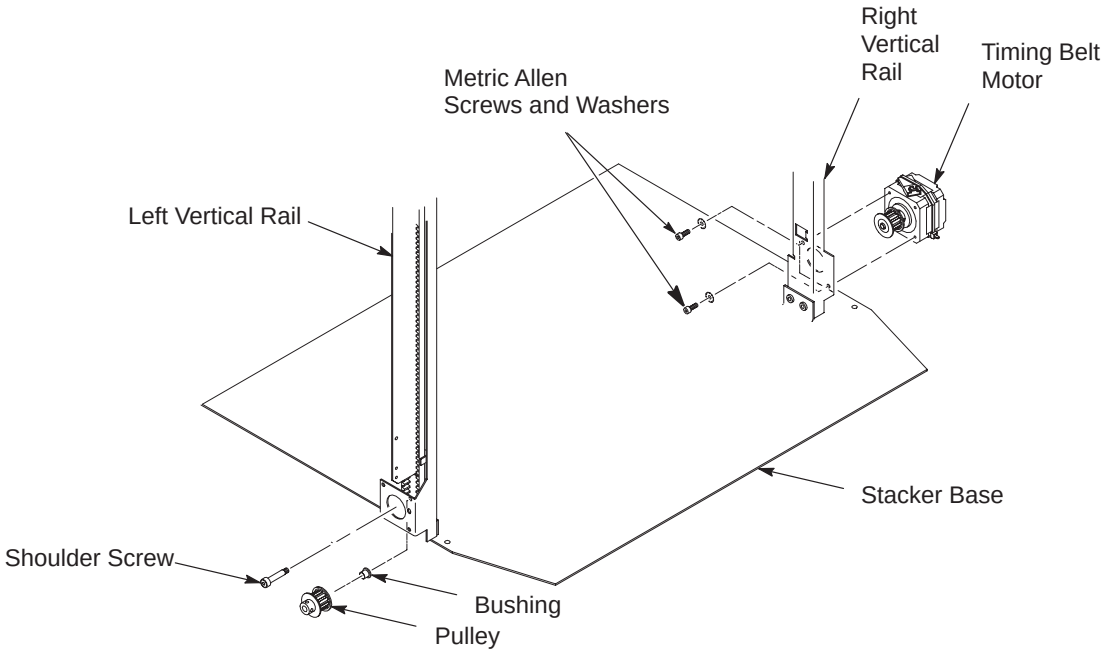


Figure 77. Removing the Timing Belt Pulley and Motor

5. Loosen the two setscrews on the motor pulley and remove the pulley. (See Figure 78.) Go to step 6.

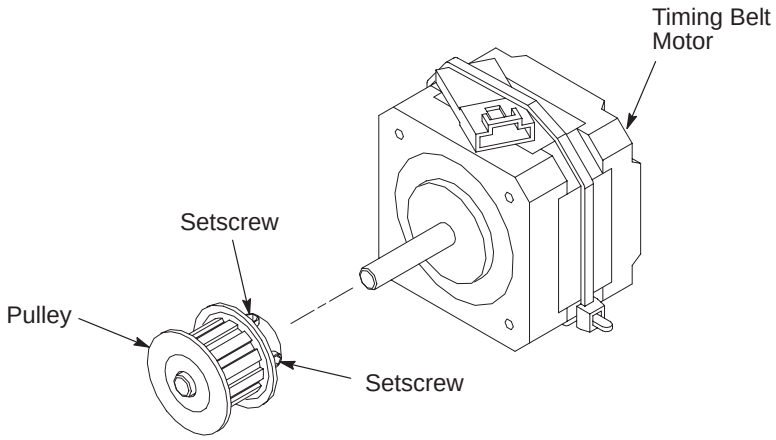


Figure 78. Removing the Timing Belt Motor Pulley

6. Remove the shoulder screw, washers, and spacer that secures the constant force spring to the vertical rail. (See Figure 79.)

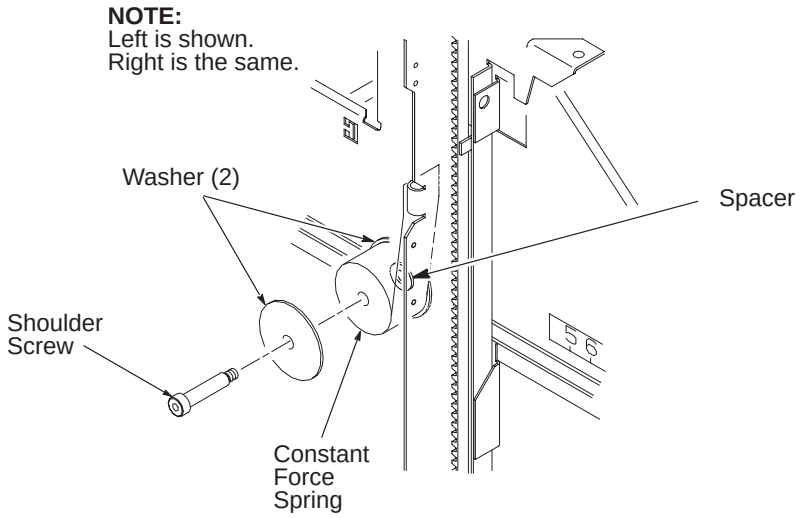


Figure 79. Releasing the Constant Force Spring

7. Remove two Allen screws from the belt clamp that secures the timing belt to the stacker frame. (See Figure 80.)

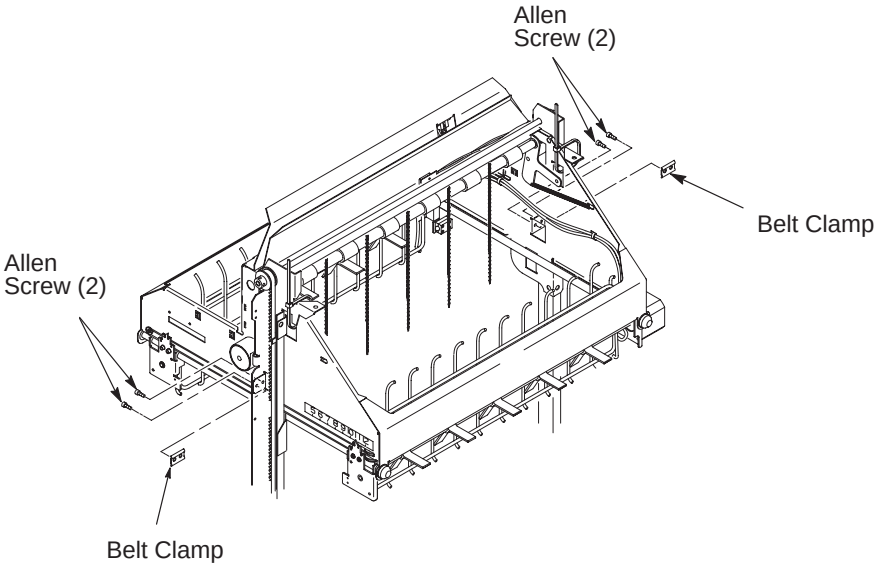


Figure 80. Removing the Belt Clamps

8. Remove the timing belt by working it around the vertical rail and constant force spring. (See Figure 81.)

9. To install a timing belt, reverse the steps of this procedure then go to step 10.

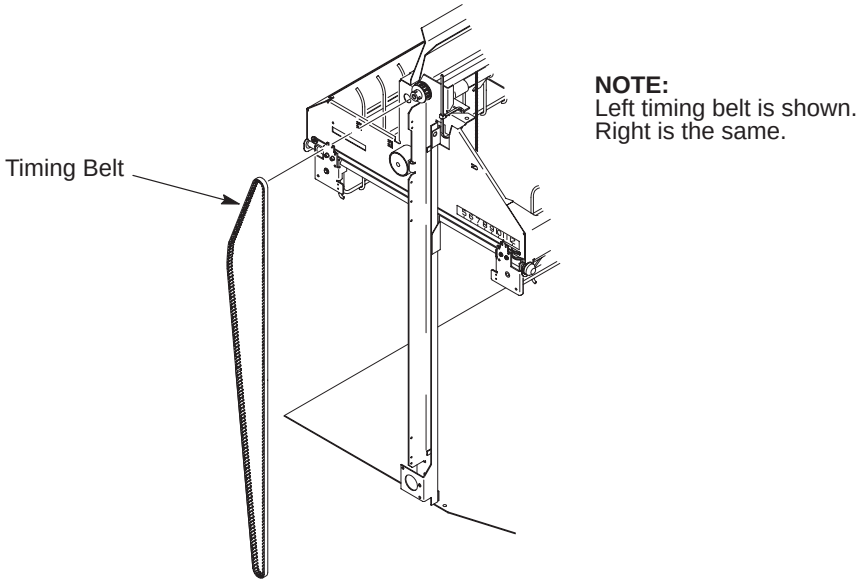


Figure 81. Removing the Timing Belt

10. After you have installed a timing belt, make the following final adjustments:

    a. Loosen the left timing belt pulley screw.

    b. Position the elevator assembly at its lowest point of travel, and apply downward pressure on the left side of the elevator assembly.

    c. While holding downward pressure on the left side of the elevator assembly, tighten the timing belt pulley screw.

Illustrated Parts Breakdown

The Illustrated Parts Breakdown (IPB) consists of exploded drawings of the power stacker assembly and subassemblies. Each drawing also has a list of replaceable parts.

Only replaceable parts are assigned part numbers. If a part or assembly is damaged but does not have a part number, replace the entire power stacker assembly.

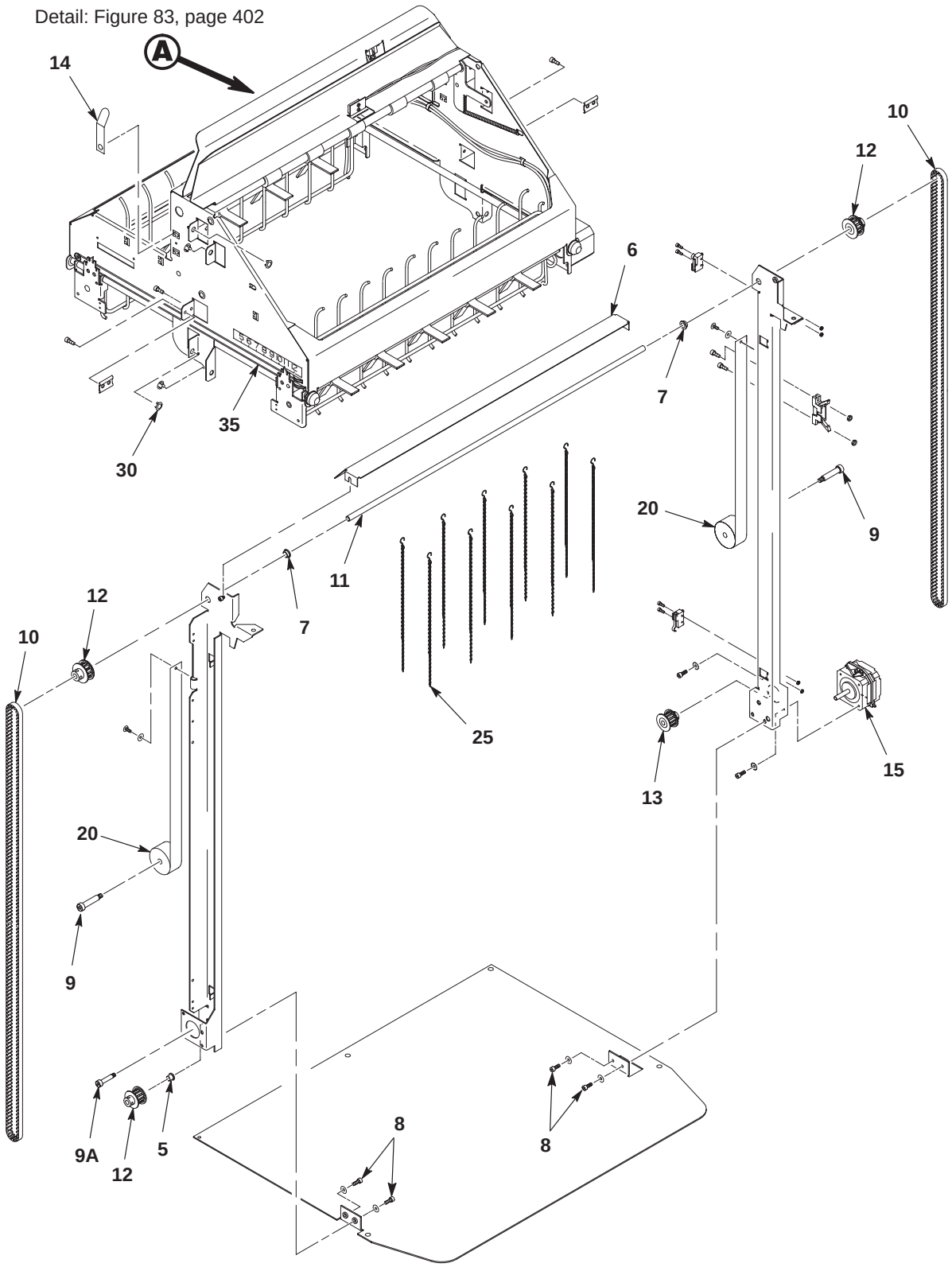


Figure 82. Stacker Assembly

Item No.	Part No. (Order No.)	Description	Notes
5	Ref	Flanged Bearing	Part of item 36
6	24H8966	Paper Deflector	
7	Ref	Clip-On Bearing	Part of item 36
8	Ref	Screw, Torx, 6–32x.25	Part of item 36
9	Ref	Screw, Shoulder, 10–32	Part of item 36
9A	Ref	Screw, Shoulder, 8–32	Part of item 36
10	24H8968	Timing Belt	
11	24H8996	Shaft, Lift	
12	24H9002	Pulley, Timing Belt	
13	24H9001	Pulley, Motor	
14	57G1521	Clip, Grounding	
15	24H8969	Motor	
20	24H8970	Constant Force Spring	
25	24H8971	Chain	Mount chains outboard of shafts
30	Ref	Nylon Plug	Part of item 36
35	24H8973	Cable	
36	24H9004	Stacker Hardware Kit	Kit not illustrated
		Other Parts and Assemblies:	
	24H8974	Control Panel Assembly	See Figure 71, page 390.
	Ref	Rail Cable, Power Stacker	See page 327.
	24H8975	Power Cable, Power Stacker	See page 326.
	24H8976	Logic Cable, Power Stacker	See page 325.
	Ref	Frame Cable, Power Stacker	See page 324.
	24H8962	Rear Door, Extended, Power Stacker	Not Illustrated
	24H8963	RE Ship Kit, Printer w/Power Stacker	Not Illustrated

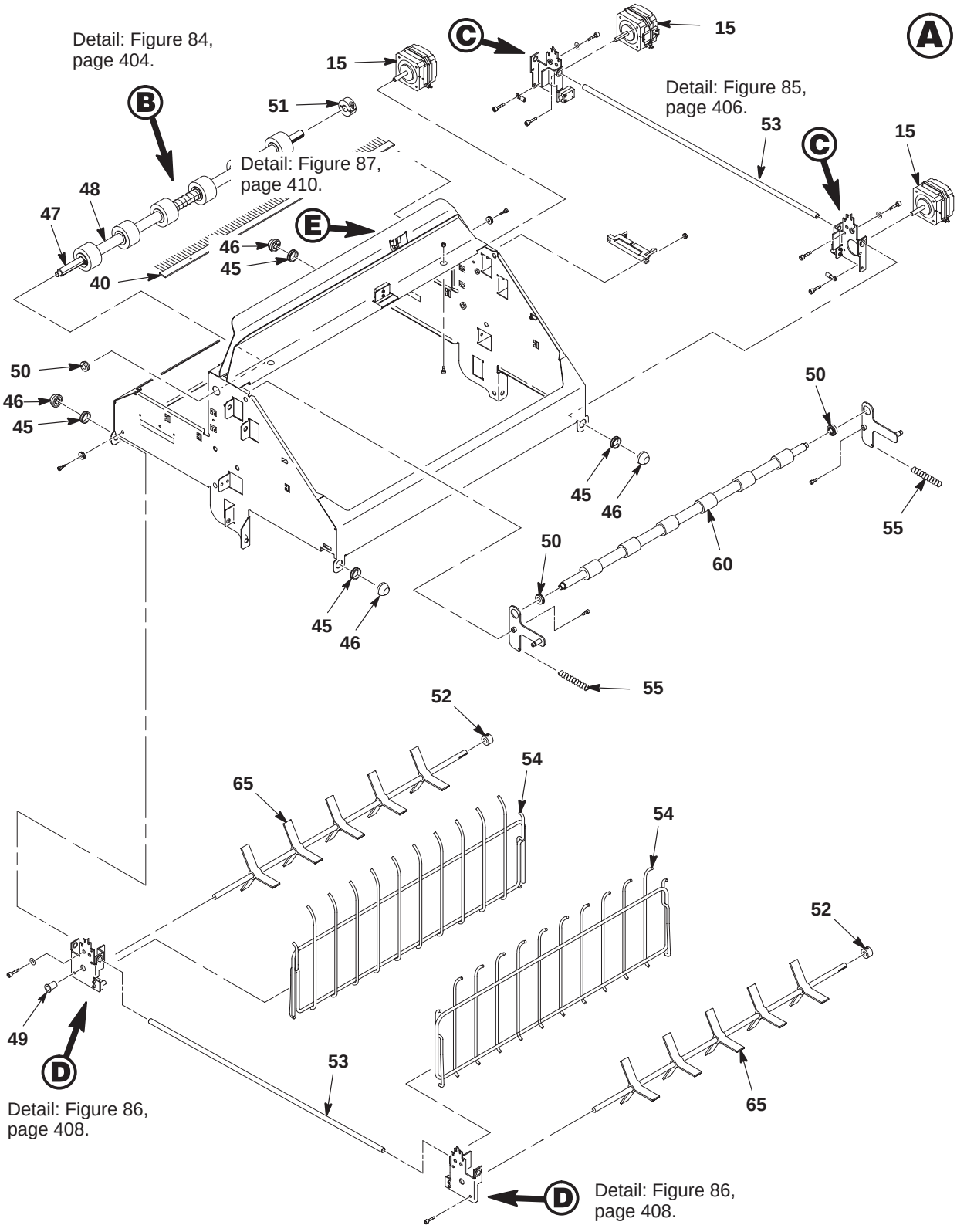


Figure 83. Stacker Detail: Motor, Roller, and Paddle Assemblies

Item No.	Part No. (Order No.)	Description	Notes
15	24H8969	Motor	
36	24H9004	Stacker Hardware Kit	Kit not illustrated
40	24H8978	Anti-Static Brush	
45	Ref	Shear Grommet	Part of item 36
46	Ref	Cap Nut	Part of item 36
47	24H9005	Shaft, Drive Roller	
48	24H9006	Spacer, Drive Roller	
49	Ref	Bearing, Flanged	Part of item 36
50	Ref	Bearing	Part of item 36
51	24H9003	Collar Clamp	
52	Ref	Collar, Set Screw	Part of item 36
53	24H8997	Support Shaft	
54	24H8998	Fence, Wireform	
55	24H8981	Extension Spring	
60	24H8982	Idler Roller	
65	24H8983	Paddle, Power Stacker, P5XXX	

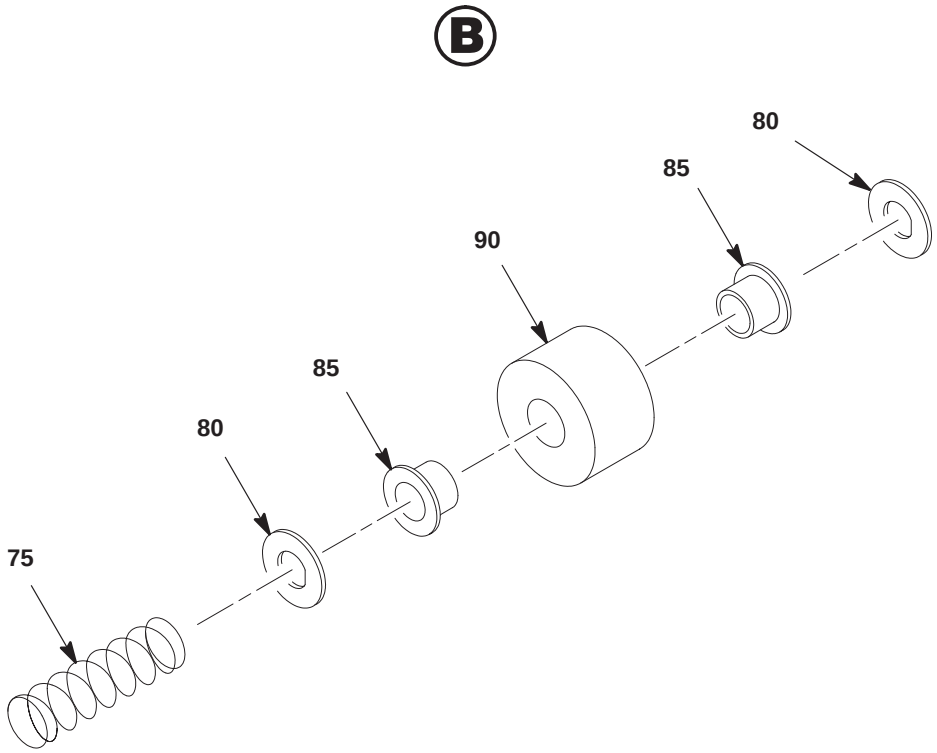


Figure 84. Stacker Detail: Rollers

Item No.	Part No. (Order No.)	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
75	24H8985	Compression Spring	
80	Ref	Friction Washer	Part of item 36
85	Ref	Flanged Bushing	Part of item 36
90	24H8988	Drive Roller	

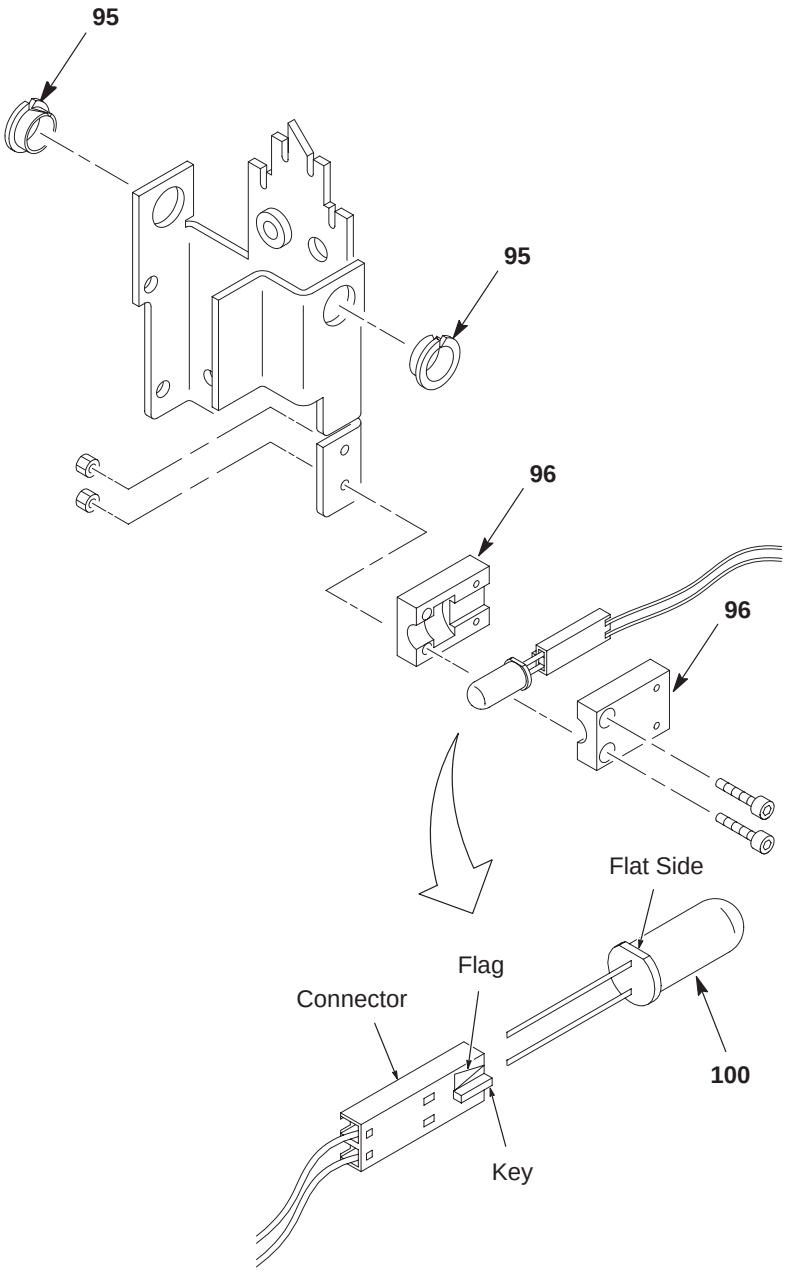


Figure 85. Stacker Detail: Motor Bracket

Item No.	Part No. (Order No.)	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
95	Ref	Clip-On Bearing	Part of item 36
96	24H8999	Holder, LED, Round	
100	24H8989	LED, IR, T-1, 3/4	

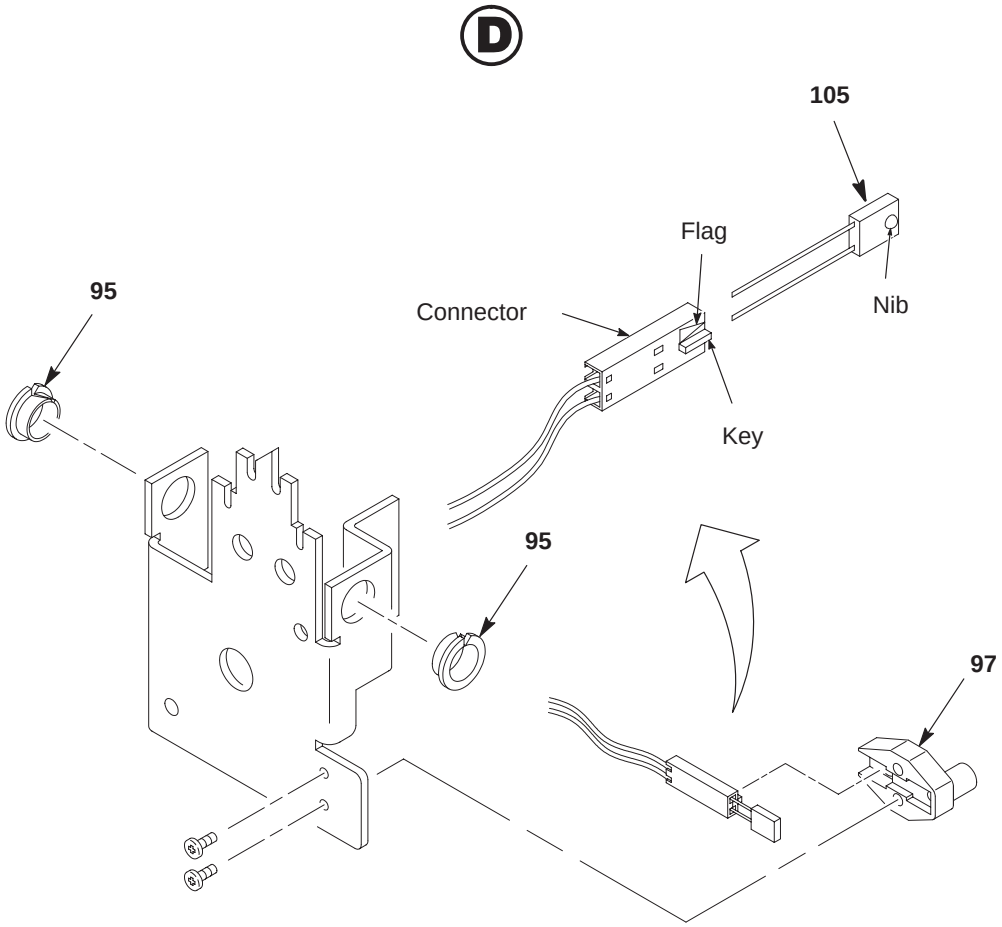


Figure 86. Stacker Detail: Elevator Bracket

Item No.	Part No. (Order No.)	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
95	Ref	Clip-On Bearing	Part of item 36
97	24H9000	Holder, LED, Flat	
105	24H8990	Photodarlington, NPN, Rectifier	

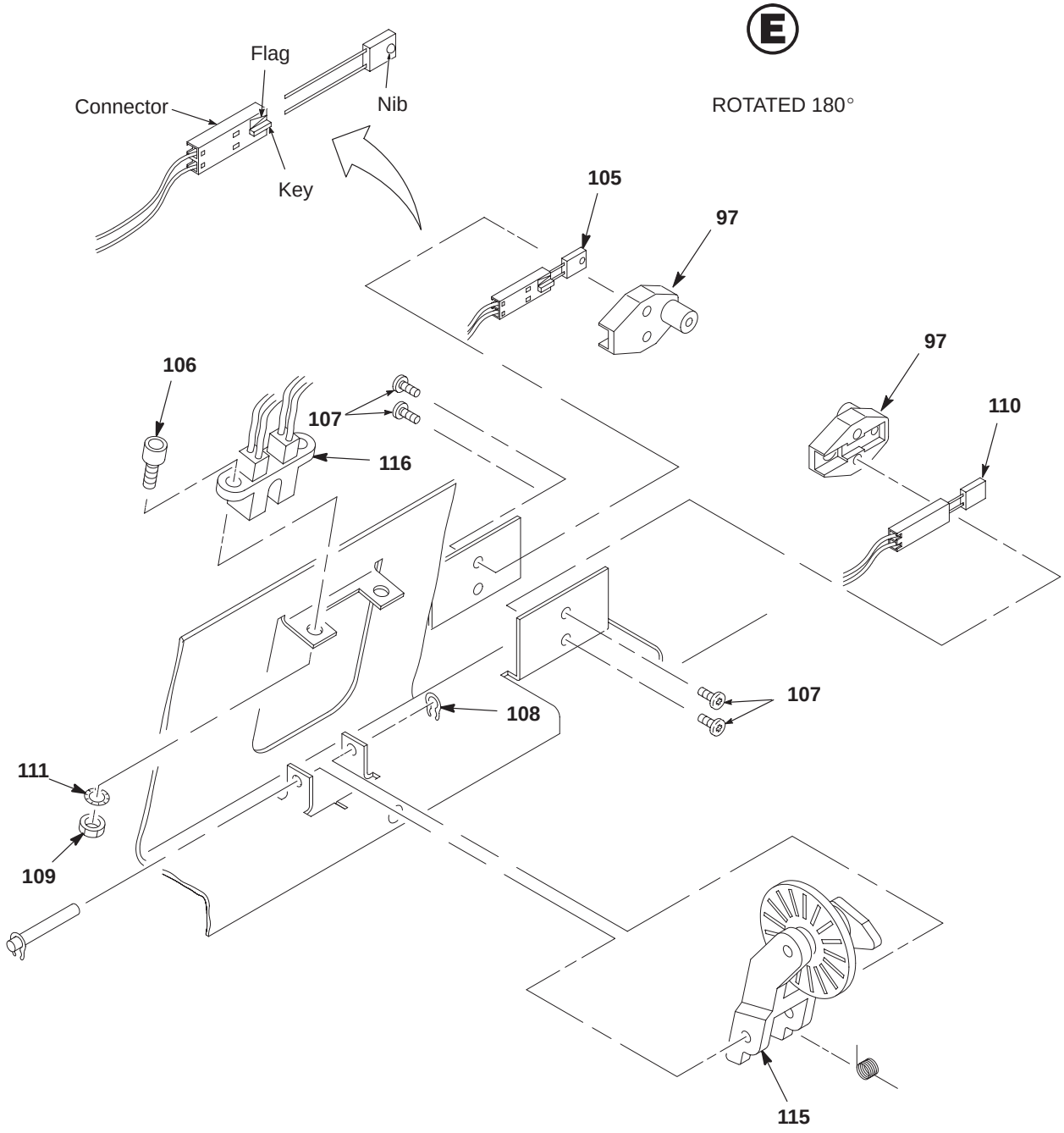


Figure 87. Stacker Detail: Paper Motion Detector

Item No.	Part No. (Order No.)	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
97	24H9000	Holder, LED, Flat	
105	24H8990	Photodarlington, NPN, Rectifier	
106	Ref	Screw, Socket Cap, 4x.25	Part of item 36
107	Ref	Screw, Panhead, Type B, 2x3/16	Part of item 36
108	Ref	Retaining Ring, .093	Part of item 36
109	Ref	Nut, Hex, 4–40	Part of item 36
110	24H8991	LED, IR, Rectangular	
111	Ref	Lock Washer, #4	Part of item 36
115	24H9008	Wheel Assembly, PMD	
116	24H9007	Sensor Assembly, PMD	

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